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About the Journal

CIET, NCERT has been a premier institution for development and dissemination of resources and techniques related to Educational Technology (ET) for better understanding of teaching-learning at school level. With renewed thrust on educational technology using digital platforms, the need for a quality journal on educational technology in India is felt more than ever. Keeping this in regard, Indian Journal of Educational Technology will be a medium for scholarly presentation and exchange of information between researchers, professionals and practitioners of technology related fields of education. The journal aims at covering disciplinary areas of educational technology (ET) for school education and teacher education. The specific objectives of this journal are: i) to provide an open access journal for sharing updated and peer reviewed research on Educational Technology for easy access and ii) to promote research on the integration of technology in school and teacher education, promote innovative practice, and inform policy debates on educational technology. This bi-annual open access online peer reviewed journal will be a platform for exchange of ideas and would also become a basis for further innovation in ET in school and teachers' education.

Notes to Contributors

Indian Journal of Educational Technology is a peer-reviewed bi-annual journal especially designed for scholarly discourse of use of various forms of technology in education. Some of the themes encompassed under its broad purview are: Education Technology (ET), Information and Communication Technology (ICT) in education, Distance education and technology, Technological integration into pedagogy and content, Open Educational Repositories (OER) and FOSS, Innovation in educational system, Computer-based learning, Audio-video and multimedia in education and issues thereof, Technology cognition and curriculum, Impact of technology in education, Nature of technology and learning, Mobile learning, Learning through social media, Technology assisted evaluation systems, Technology support for differently abled population, Flipped classroom, Virtual and Augmented Reality, Artificial Intelligence, robotics and education, Impact of technology on learning, Social media and children, Economics of technology and its impact on education system, Educational planning administration and technology and Online courses for school education and teacher education. We look forward to your contributions in the coming issues. Your feedback and suggestions are also welcome on the following address:

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Editorial

मन एव मनुष्याणां कारणं बन्धमोक्षयोः ।

(The mind is the cause of bondage and emancipation for humans)

(*Brahmabindu Upanishad*)

The avowed goals of NEP 2020 are to increase access to educational opportunities, enhance the quality of the education offered to millions of students, bring equity into the educational systems given the existence of vast diversities in the population, make education more affordable, and create an accountable educational system. The use and integration of technology in education, too, have similar concerns regarding access, quality, equity, affordability, and accountability. In India, the scale at which we are functioning is staggering. We have more than 334 million students studying in more than 900 universities, 17000 teacher education institutions and 1.5 million schools, of which nearly 1 million are government schools. Continuous professional development (CPD) of 10 million teachers and imparting skill development to youth comprising two-thirds of India's population remain challenging tasks before us. As per ASER (2021) report, 67.6% of all enrolled children have at least one smartphone available at home, but 26% have no access. The 75th round of the Household Social Consumption survey by NSSO (2020) revealed that nearly 4% of rural households and 23% of urban households only possessed computers, and almost 24% of the households in the country had internet access in the survey year, 2017-18. The proportions were 15% among rural and 42% among urban households. Across India, only one in ten households had a computer — whether a desktop, laptop or tablet. Moreover, having computers or the internet had no guarantee that one use them also, as only a small percentage of Indians above the age of 5 years (20 %) had the basic digital literacy to use digital devices or access the internet. Given the context in which we operate, the use and integration of technology in education have to do with children's learning more than the technology itself.

There is a tendency to consider technology a panacea for all the ills of the country's educational system, and each time a new technology emerges, one starts believing that the miracle is around the corner. Miracles have not happened despite using technology in a big way. We have yet to achieve 100 % literacy rates; quality education has remained elusive to the vast majority of students; technology has failed to empower students to overcome the discriminations and challenges faced by children with special needs (CWSN) or children belonging to marginalised sections. Therefore, the use and integration of technology in education cannot be seen bereft of the socio-economic context. Many studies have pointed to the lack of adequate infrastructure and teachers' training as the key barriers to effective technology integration in diverse educational settings like India. Teachers' fear of being replaced by technology too impedes the use and integration of technology. Addressing these challenges requires coordinated and collaborative interventions from various quarters at various levels.

Recently, we have seen similar expectations for using artificial intelligence in education (AIED). AIED has immense opportunities to offer. One area in which it can help is overcoming the central contradictions (that we provide uniform instructions to a class of diverse learners) that exist in any classroom. AIED makes personalised adaptive learning (PAL) a possibility. As teachers have to work increasingly in

artificial intelligence (AI) rich environments, their training on various aspects of AI, such as data mining, algorithms, and machine learning, as well as their ethical and human use, is paramount. An algorithm, which is the keystone of AI, can be biased, reflecting the mindset of the developers or data on which the algorithm is based can be specious. Therefore, responsible use of AI is sine qua non for its application in education. It must be remembered that it can solve many of our educational problems, but not all of them. Technology is best served if we lead them, not vice-versa.

In November 2024, the Union Cabinet approved an ambitious One Nation One Subscription (ONOS) scheme, which seeks to provide the best international scholarly articles, papers and journals to all the stakeholders, viz., students, researchers, teachers, faculty members, scientists of all disciplines, including those in tier 2 and tier 3 cities, etc. A total of ₹ 6,000 crore has been allocated for this initiative, from 1 January 2025 to 31 December 2027. The funding will cover the subscription charges for all participating institutions across the three years. Access to journals is being provided through a national subscription coordinated by the Information and Library Network (INFLIBNET) Centre, an autonomous inter-university centre of the University Grants Commission (UGC), Gandhinagar, Gujarat. One can access the journals through a unified portal, "One Nation One Subscription" (https://www.onos.gov.in/). This is a crucial scheme, especially for institutions that face a resource crunch in subscribing to quality and costly international journals. Moreover, different institutions paid a hefty amount as subscription charges for the same journals, thus indulging in wasteful expenditure of the public money.

This edition brings together a diverse collection of research articles, review articles, general articles, communication and book review exploring critical themes in digital and blended learning. These articles delve into the teacher's attitude towards blended learning, the impact of SWAYAM MOOCs, and the effectiveness of online and offline internship training. Our authors examine blogging as a form of action research, the use of branching programming learning materials in economics, and the role of revised Bloom's Taxonomy in AI-driven digital learning environments. Additionally, they explore the mental health effects of social media on educated individuals, the potential of augmented reality in mathematics education, and the rise of augmented podcasts and YouTube educational videos as transformative tools. This compilation not only contributes to academic discourse but also offers valuable insights to educators, researchers and policymakers navigating the digital educational era.

(ABHAY KUMAR)

Editor

Research Article

Students Attitude for Blended Learning at Higher Education Level

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Abstract

Education has leapt over from the conventional mode to the modern way of teaching with the accessibility of various online platforms. A hybrid instruction model called Blended Learning, conglomerates the strengths of each conventional and online mode of learning experiences. This study explores to what extent university students have an attitude towards the blended learning approach with the objectives laid to investigate and compare the attitude of undergraduate and postgraduate students belonging to two science and two non-science streams their gender, and undergraduate and postgraduate education level. The paper analyses the result of a survey conducted on 160 students randomly selected through stratified random sampling comprising 40 students from each of the four departments of Osmania University, including 20 undergraduates and 20 postgraduates, equally representing 20 males and 20 females. The data collected through an opinionnaire on four different aspects of the blended learning model, i.e. BL environment, BL structures, BL implementation, and BL assessment and evaluation; on a 5-point Likert scale showed significant differences exist among different streams, gender, and educational level of students towards blended learning method.

Keywords: Blended learning, ICT skills, Higher Education, Students attitude

Introduction

One of the fundamental principles of NEP-2020 is the integration of technology in educational transactions and reaching the socio-economically disadvantaged groups, cutting across the barriers of language, location, and digital divide. In higher education, the policy recommends multidisciplinary, holistic, equitable, and progressive quality higher education to fulfil the requirements of the techno-modern era and achieve Sustainable Development Goal 4 (SDG4) by 2040 (National Education Policy, 2020). Further, this revolutionary policy paves the way for transforming the regulatory system of higher education and establishing and expanding national-level initiatives for managing technology-based implementations such as NEFT, NDEAR, DIKSHA, and SWAYAM. With the advent of disruptive technologies and a plethora of technological platforms, future learners shall witness borderless classrooms irrespective of geographical location and independent of any educational facilitators (Kumar & Ganesh, 2022).

NEP 2020 Para 24.4 (i) recommends using effective blended learning models. As per UGC (2022), Blended learning is a meaningful merging of digital learning resources with in-class instruction. This significant fusion of on-campus and online modes provides a better learning environment.

A few essential characteristics of Blended Learning include (i) increased student engagement, (ii) provision for self-reliance, continuous, and experiential learning, (iii) improved student learning outcomes, (iv) flexible learning environment, and (v) enhanced peer-to-peer and peer-to-teacher interaction.
The different modes/structures of Blended Learning, according to UGC (2022), are-

(i) Blended "on-campus (face-to-face class) model" - This requires the replacement of some time of in-person classes with online activities.

(ii) Blended "virtual class model" is mainly conducted online with a significant amount of on-campus academic learning like discourses and laboratory experimentations.

(iii) "The flipped classroom model" - This requires students to watch a lecture video online and perform practical activities like group work, projects, and exercises in the classroom.

(iv) "The rotation model" - This may involve students moving in from one station to another like lab, individual, or station rotation; including an online learning lab.

(v) "The self-blend model" - This requires students to make their own choices for courses online and in person as per their needs and interests.

(vi) "The blended MOOC" - Students access MOOCS outside the classroom and meet in person discussions and classroom activities.

(vii) "Flexible-mode courses" - This hybrid instruction model allows students to choose to attend the class either physically or online.

Blended learning requires suitable technologies and online platforms for implementing various teaching-learning approaches such as internet-based, project-based, TAB-based remote learning, online assessments, and virtual labs; and teaching techniques that can be implemented are cooperative learning strategies, discussions on case studies, brainstorming, mind-mapping, concept-mapping, creative presentations, etc.; so an Indian Model /Framework is created for its implementation following the IPSIT model that is to (i) Recognize resources and learner-focussed activities, (ii) Provide materials and make LMS activity announcements, (iii) Providing support and scaffolding for learners, (iv) Identifying gaps in learning and providing comments, and finally (v) Evaluating (UGC, 2022).

In this context, the study tries to understand the attitudes of graduate and postgraduate students genderwise from four different streams, viz. science, engineering, arts, and social science, and education departments of Osmania University and its affiliated college in Telangana towards Blended Learning model which seeks students attitudes upon (i) BL environment, includes opinions on the features of blended learning model; (ii) BL structures, includes opinions on the different modes/structures of blended learning model and synchronous and asynchronous e-learning; (iii) BL implementation, includes opinions on availability of ICT infrastructure and

digital technology at the university level and at individual level; and (iv) BL assessment and evaluation, includes opinions on online and offline mode of examination and feedback.

At the higher education level, a few key findings of AISHE 2019-20 (2020) report are -

(i) Infrastructure for Institutions at the university level (Para 2.8), 94 per cent have libraries, 85 per cent have laboratories, 81 per cent have computer centres, 62 per cent have solar power generation, 55 per cent are connected to NKN (National Knowledge Network), 40 per cent are connected to NMEICT.

(ii) Pupil Teacher Ratio (PTR) (Para 2.4.1) in Universities and Colleges is 28 in regular mode;

(iii) At the higher education level, the Gross Enrolment Ratio (GER) (18-23 years), (Para 2.3), is 27.1 per cent, comprising 26.9 per cent of the male population and 27.3 per cent of the female population,

(iv) Gender Distribution (Para 2.2.4), 50.8 per cent of males and 49.2 per cent of females are enrolled at the Undergraduate level, whereas slightly less, 40 per cent male and 60 per cent female at the Postgraduate level;

(v) Discipline/Subject-wise enrolment (Para 2.2.3), the majority of undergraduate students are in the Arts stream, followed by Science, Commerce, Engineering, and Technology. Whereas the Management and Social Science streams contain most of the students at the postgraduate level.

Review of Literature

Adenekan and Jatto (2023) studied 130 postgraduate students' attitudes towards blended learning and reported a positive attitude, with 94.7 per cent of postgraduates stating blended learning as beneficial, 89.5 per cent as interesting, 94.8 per cent of respondents cited internet connectivity issues as a major challenge for implementing blended learning; conversely, 84.2 per cent supported physical classes for understanding some topics, and 89.5 per cent stated blended learning reduces physical attention.

Tamang and Naraginti (2022) found favourable attitudes of post-graduate science stream students concerning the implementation of the blended learning model. Zhu et al. (2013) also found an optimistic attitude toward hybrid learning from University students when exposed to the online learning environment. According to Mahato et al. (2021) demographic variables such as Gender, Locality, Semester, Internet User, Family type, Caste, and Guardian's Occupations had no significant impact when compared to the significant differences in educational streams like Arts, Science, and Commerce, of Post Graduate students for a hybrid model of learning.

Aladwan et al. (2018) indicated a positive attitude of University students towards blended learning and stressed its effectiveness over classical approaches of imparting knowledge, where students take immense responsibility for their own learning process. Whereas Falah and Chairuddin (2022) reported drawbacks with regard to internet connections and limitations with instructors' strategies for online teaching-learning. In another study conducted by Bindu and Bharathi (2022) on university students' perceptions of the mode of examination pattern, viz., online and offline examinations, the results revealed mixed interest as the majority of students were already adjusted to the traditional offline system

and its easiness to pass. However, students expressed their positive opinions on the associated benefits of online examinations such as time-saving, less tiring, minimized cheating with accuracy and the possibility of obtaining fast results, and eco-friendly in less paper usage.

Bhosale (2022) reported that the All India Gaming Federation (AIGF) has observed that gamification of educational content has proven to be an essential tool in making the content easier to understand with the use of gaming elements. Children with learning disabilities and introverts can learn in an interactive way, improving hand-eye coordination, reaction time, and reflexes in children, which is handy in several real-life situations. Gamification of the syllabus is slowly gathering attention post-pandemic, as children are using apps and techniques to learn difficult concepts.

Das (2021) studied the outlook of students and instructors concerning hybrid models to be more positive, efficient, and more viable than traditional learning and online learning and stated the need for teachers to select a proper blended learning model. Huang (2016) revealed university students' positive attitude towards mixed learning, as most students preferred blended learning to either f2f or online learning alone, while f2f learning was preferable and advantageous for learning world knowledge and facilitating learners' interests in learning English, whereas e-learning was helpful in listening skills. Similarly, Bakeer (2018), through an experimental study, found positive attitudes of undergraduate students towards English language courses taught through the blended learning model enhanced students' language skills as well as learner autonomy and motivation. Further, Munir et al. (2021) reported that all participants agreed that blended learning facilities promote a better understanding of EFL subjects.

Kintu et al. (2017) surveyed 238 university students; and found male students performed better than females in a blended learning environment. Results showed blended learning design features (technology quality, online tools and resources) and student characteristics (attitudes to blended learning, and self-regulation) predicted student satisfaction with blended learning as an outcome.

Singh (2020), in the context of NEP-2020 and the reach of technology, stated that the availability of computers is far less than 5 per cent in countryside households compared to 23.4 per cent in metropolitan areas. Similarly, less than 15 per cent of rural inhabitants are connected online as against 42.0 per cent of urban inhabitants. The majority of the students from underprivileged communities do not have online learning devices/internet connectivity/electricity. Students belonging to both urban and rural zones mainly use mobile phones for accessing internet connectivity.

Based on PRISMA guidelines, Ashraf et al. (2021) conducted systematic reviews on blended learning and found that the majority of the studies were conducted at higher education level with students as the participants and indicated that a dearth of ICT infrastructure and skills are the most frequent problems experienced by educators, pupils, and organizations. It was found that the majority of studies did not focus on any particular subject matter. Moreover, blended learning affects students psychological (self-regulation, satisfaction, and engagement) and behavioral outcomes (academic performance in various subjects).

In the light of review of literature, it felt significant to conduct a fresh study of different subject streams and education level of Osmania University students to understand their attitudes towards blended learning.

Objectives of the Study

(1) To investigate the attitude of undergraduate and postgraduate students belonging to science, engineering, arts and social science, and education streams towards the blended learning model.

(2) To compare the attitude of undergraduate and postgraduate students belonging to science, engineering, arts and social science, and education streams towards the blended learning model.

(3) To investigate the attitude of undergraduates and postgraduates towards the blended learning model with respect to gender.

(4) To compare the attitude of undergraduates and postgraduates towards the blended learning model with respect to gender.

(5) To investigate the attitude of undergraduates with that of postgraduates with respect to educational level, belonging to science, engineering, arts and social science, and education streams towards blended learning model.

(6) To compare the attitude of undergraduates with that of postgraduates with respect to educational level, belonging to science, engineering, arts and social science, and education streams towards blended learning model.

Hypotheses of the Study

(1) There is no significant difference between the attitude of undergraduate and postgraduate students belonging to science, engineering, arts and social science, and education streams towards the blended learning model.

(2) There is no significant difference between the attitude of undergraduates and postgraduates towards the blended learning model with respect to gender.

(3) There is no significant difference between the attitude of undergraduates with that of postgraduates with respect to educational level, belonging to science, engineering, arts and social science, and education streams towards blended learning model.

Methodology

A Descriptive Survey study was conducted on 160 students randomly chosen via stratified random sampling from the population of students studying in science, engineering, arts and social science, and education departments of Osmania University and one of its affiliated colleges in Telangana.

Forty students from each of the four departments comprising, viz. (i) 20 Postgraduate students from the University College of Science and 20 Undergraduate students from its affiliated college; each consisting of 10 boys and 10 girls. (ii) 20 Postgraduate students and 20 Undergraduate students from the University College of Engineering, each consisting of 10 boys and 10 girls. (iii) 20 Postgraduate students from the University College of Arts and Social Sciences and 20

Undergraduate students from its affiliated college, each consisting of 10 boys and 10 girls. (iv) 20 Postgraduate students and 20 Undergraduate students from the University College of Education, each consisting of 10 boys and 10 girls. Altogether, the sample is 80 Undergraduates and 80 Postgraduates by education level and 80 boys and 80 girls by gender. The Independent variables considered are Gender, Education level, i.e. Undergraduate students and Postgraduate students, and different streams, i.e. Science, Engineering, Arts and Social Science, and Education student's attitudes towards the Blended Learning model as a Dependent variable.

The data was collected through an opinionnaire consisting of 52 statements on four different aspects of the blended learning model, i.e. (i) Blended Learning Environment (14 questions), (ii) Blended Learning Structures (16 questions), (iii) Blended Learning Implementation (14 questions), and (iv) Blended Learning Assessment and Evaluation (08 questions); based on a Likert scale with five possible outcomes (Strongly Agree, Agree, Undecided, Disagree, and Strongly Disagree); to find whether any significant differences exist among the sample towards blended learning approach. The tool was validated, and the reliability coefficient was found to be .694, calculated using Cronbach's alpha for these 52 questions, which indicated a reliable instrument for executing the study.

Analysis and Interpretation

This section includes descriptive and inferential analysis of the sample for the set objectives and hypotheses.

Objective 1: "To investigate the attitude of undergraduate and postgraduate students belonging to science, engineering, arts and social science, and education streams towards the blended learning model", crosstabulations are performed of the frequencies of students opinion towards blended learning with respect to different colleges, viz. UCS, UC^{E}, UCASS, UCEdn.

Table:1- Overall Student's Opinion towards Blended Learnin

	Frequency	Percent	Valid Percent	Cumulative Percent
Strongly Disagree	33	20.6	20.6	20.6
Disagree	33	20.6	20.6	41.3
Undecided	33	20.6	20.6	61.9
Agree	29	18.1	18.1	80.0
Strongly Agree	32	20.0	20.0	100.0
Total	160	100.0	100.0	

Table 1 shows, there is not much difference among the frequency of total opinions of students i.e. strongly disagree (33, 20.6 per cent), disagree (33, 20.6 per cent), undecided (33, 20.6 per cent), agree (29, 18.1 per cent) and strongly agree (32, 20.0 per cent) towards blended learning model.

Table-2: Cross tabulation of Students Opinion towards Blended learning among four Colleges, viz. UCS, UCE, UCASS, UCEdn

UCS		College				Total
		UCE	UCASS	UCEdn		
Total BL	Strongly Disagree	5	14	3	11	33
	Disagree	6	14	2	11	33
	Undecided	6	4	15	8	33
	Agree	4	1	18	6	29
	Strongly Agree	19	7	2	4	32
Total		40	40	40	40	160

Table 2 shows the total sample; University College of Science (UCS) and University College of Arts and Social Sciences (UCASS) students showed favourable attitudes, whereas University College of Engineering (UCE) and University College of Education (UCEdn) students showed unfavourable attitude towards blended learning model.

Objective 3: "To investigate the attitude of undergraduates and postgraduates towards the blended learning model with respect to gender", crosstabulations are performed of the frequencies of students opinion towards blended learning with respect to students gender.

Table-3: Cross tabulations of Students Opinions towards Blended learning with respect to Students' Gender

Male		Gender		Total
		Female		
Total BL	Strongly Disagree	19	14	33
	Disagree	19	14	33
	Undecided	12	21	33
	Agree	14	15	29
	Strongly Agree	16	16	32
Total		80	80	160

Table 3 shows that, compared to male students, female students exhibit a positive attitude towards blended learning.

Objective 5: "To investigate the attitude of undergraduates with that of postgraduates with respect to educational level, belonging to science, engineering, arts and social science, and education streams towards blended learning model", crosstabulations are performed of the frequencies of students opinion towards blended learning with respect to students educational level.

Table-4: Cross tabulations of Students' Opinions towards Blended learning with respect to Students' Educational Level

U.G.		Educational Level		Total
		P.G		
Total BL	Strongly Disagree	18	15	33
	Disagree	16	17	33
	Undecided	14	19	33
	Agree	13	16	29
	Strongly Agree	19	13	32
Total		80	80	160

Table 4 shows that Undergraduate students have a slightly more favourable attitude towards blended learning than postgraduate students.

Hypothesis 1: There is no significant difference between the attitude of undergraduate and postgraduate students belonging to science, engineering, arts and social science, and education streams towards the blended learning model.

Table-5: The Distribution of Students among four Colleges, viz. UCS, UCE, UCASS, UCEdn

College	Frequency	Valid Percent	Cumulative Percent
UCS	40	25.0	25.0
UCE	40	25.0	50.0
UCASS	40	25.0	75.0
UCEdn	40	25.0	100.0
Total	160	100.0	

Table 5 indicates distribution of students sample, comprising each 40 making 25 per cent of the sample from four different colleges viz. University College of Science (UCS), University College of Engineering (UCE), University College of Arts and Social Sciences (UCASS), and University College of Education (UCEdn).

Table-6: F-value of Students among four Colleges, viz. UCS, UCE, UCASS, UCEdn

Total BL	ANOVA	Sum of Squares	df	Mean Square	F	Sig.
Total BL	Between Groups	8225.619	3	2741.873	9.690	.000
	Within Groups	44142.825	156	282.967		
	Total	52368.444	159			

From Table 6, the F-ratio is found to be 9.690 (3df), and the p-value is .000<0.05α, which is statistically significant. Therefore, the null

hypothesis is rejected, and the alternate hypothesis is accepted, which states that there is a significant difference between the attitude of undergraduate and postgraduate students belonging to science, engineering, arts and social science, and education streams towards the blended learning model.

Further, Post Hoc Comparisons were conducted to compare students among four colleges, viz. UCS, UCE, UCASS, UCEdn with respect to students attitudes towards Blended learning.

Table-7: Post Hoc Comparisons of Students among four Colleges, viz. UCS, UCE, UCASS, UCEdn

Total BL	College	Comparison College	Fisher LSD Test	
			Mean Difference	Sig.
Total BL	UCS	UCE	17.77500	.000
		UCASS	3.25000	.389
		UCEdn	12.95000	.001
	UCE	UCS	-17.77500	.000
		UCASS	-14.52500	.000
		UCEdn	-4.82500	.201
	UCASS	UCS	-3.25000	.389
		UCE	14.52500	.000
		UCEdn	9.70000	.011
	UCEdn	UCS	-12.95000	.001
		UCE	4.82500	.201
		UCASS	-9.70000	.011

Post Hoc Comparisons from Table 7 revealed significant pairwise differences in students' attitudes toward Blended learning between the mean scores of Colleges, i.e. UCS and UCE p-value is .000<0.05α; UCS and UCEdn p-value is .001<0.05α; UCE and UCASS p-value is .000<0.05α; UCASS and UCEdn p-value is .011<0.05α. Whereas insignificant pair-wise differences existed in students' attitudes toward Blended learning between the mean scores of Colleges, i.e. UCS and UCASS p-value is .389>0.05α; UCE and UCEdn p-value is .201>0.05α.

Hypothesis 2: There is no significant difference between the attitude of undergraduates and postgraduates towards the blended learning model with respect to gender.

Table-8: Gender-wise Distribution of Students among four Colleges, viz. UCS, UCE, UCASS, UCEdn

Gender	Frequency	Valid Percent	Cumulative Percent
Male	80	50.0	50.0
Female	80	50.0	100.0
Total	160	100.0	

Table 8 presents the distribution of students by gender, i.e. 80 male and 80 female students, each making 50 per cent of the sample.

Table-9: Mean values of Students towards Blended learning with respect to Students Gender

Total BL	Gender	N	Mean	Std. Deviation
Total BL	Male	80	202.0375	19.43014
	Female	80	206.4250	16.60164

Table 9 shows that the Mean value of 206.4250 with SD 16.60164 is higher than the Mean value of 202.0375 with SD 19.43014. Female students showed slightly better attitudes towards blended learning than Male students.

Table-10: Independent Samples t-test value of Students towards Blended learning with respect to Students Gender

Total BL	Levene's Test for Equality of Variances		t-test for Equality of Means			
	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference
Total BL	1.440	.232	-1.536	158	.127	-4.38750

Table 10 reveals that the F-ratio is found to be 1.440 (158 df), and the p-value is .232>0.05α, which is statistically not significant. The t-ratio is found to be -1.536 (158 df), and the p-value (2-tailed) is .127>0.05α, which is also statistically not significant. It is inferred that the null hypothesis; there is no significant difference between the attitude of undergraduates and postgraduates towards the blended learning model with respect to gender, is accepted.

Hypothesis 3: There is no significant difference between the attitude of undergraduates with that of postgraduates with respect to educational level, belonging to science, engineering, arts and social science, and education streams towards blended learning model.

Table-11: Education-wise Distribution i.e. Undergraduates and Postgraduates Level of Students among four Colleges, viz. UCS, UCE, UCASS, UCEdn

Education Level	Frequency	Valid Percent	Cumulative Percent
U.G.	80	50.0	50.0
P.G.	80	50.0	100.0
Total	160	100.0	

Table 11 presents distribution of students by education level i.e. undergraduate and postgraduate students comprising each 80 making 50 per cent of the sample.

Table-12: Mean values of Students towards Blended learning with respect to Students Educational Level

Total BL	Education Level	N	Mean	Std. Deviation
Total BL	U.G.	80	205.0250	17.77637
	P.G.	80	203.4375	18.59076

Table 12 shows the Undergraduate student's Mean value of 205.0250 with SD 17.77637 is higher than the Postgraduate student's Mean value of 203.4375 with SD 18.59076. Undergraduate students show a slightly better attitude towards blended learning than Postgraduate students.

Table-13: Independent Samples t-test value of Students towards Blended learning with respect to Students' Educational Level

Total BL	Levene's Test for Equality of Variances		t-test for Equality of Means			
Total BL	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference
	.037	.847	.552	158	.582	1.58750

Table 13 reveals that the F-ratio is found to be .037 (158 df), and the p-value is .847>0.05α, which is statistically not significant. The t-ratio is found to be .552 (158 df), and the value (2-tailed) is .582>0.05α, which is also statistically not significant. It is inferred that the null hypothesis that there is no significant difference between the attitude of undergraduates with that of postgraduates with respect to educational level, belonging to science, engineering, arts and social science, and education streams towards the blended learning model is accepted.

Key Findings

1. Overall opinion of students opting strongly agree and strongly disagree towards blended learning model remained mostly similar.
2. University College of Science (UCS) and University College of Arts and Social Sciences (UCASS) students showed positive attitude towards blended learning model than compared to University College of Engineering (UCE) and University College of Education (UCEdn) students.
3. Compared to male students, female students had a positive attitude towards blended learning.
4. Undergraduate students showed a positive attitude towards blended learning as opposed to postgraduate students.
5. Significant difference exists between the attitude of undergraduate and postgraduate students belonging to science, engineering, arts and social science, and education, towards blended learning model.
6. The attitudes of undergraduate and postgraduate students towards blended learning varied significantly-
    a. Significant difference exists with respect to the University College of Science (UCS)

and University College of Engineering (UCE) and University College of Education (UCEdn).

b. Significant difference exists with respect to the University College of Engineering (UCE) and University College of Science (UCS), University College of Arts and Social Sciences (UCASS).

c. Significant difference exists with respect to the University College of Arts and Social Sciences (UCASS) and University College of Engineering (UCE), University College of Education (UCEdn).

d. Significant difference exists with respect to the University College of Education (UCEdn), University College of Science (UCS), and the University College of Arts and Social Sciences (UCAS).

5. There is no gender-specific difference among the attitudes of undergraduates and post-graduates towards the blended learning model.

6. There is no specific difference among the attitudes of undergraduates with that of postgraduates with respect to their educational level, belonging to science, engineering, arts and social science, and education streams towards blended learning model.

Discussions

The results show no significant difference among students with respect to gender in their attitude towards the blended learning model, which is supported by Mahato et al. (2021) study that examined the Post-Graduate student's attitudes toward blended learning as for their Gender did not differ significantly; but with respect to their Streams (Arts, Science, and commerce) differs significantly. Similarly, the present study shows significant differences among the four streams chosen viz. Science, Engineering, Arts and Social Sciences, and Education, in view of Tamang and Naraginti (2022). With respect to Blended Learning assessment and evaluation, on online and offline modes of examination and feedback, the majority of the students opted for the offline mode due to its adherence and convenience; as Bindu and Bharathi (2022) had studied that the majority of students are already adjusted to traditional offline system and its easiness to pass. Adenekan and Jatto (2023); Das (2021); Tamang and Naraginti (2022); Aladwan et al. (2018); Bakeer (2018); Huang (2016); Falah and Chairuddin (2022) found the attitude of students and teachers towards hybrid learning as positive, effective and more viable compared to conventional learning and online learning; supports the present study. Falah and Chairuddin (2022); Ashraf et al. (2021); Singh (2020) reported that the majority of the students from underprivileged communities lack specialized digital devices, services, and resources. Hence, students had mixed reactions to the haves and have-nots of digital infrastructure over Blended Learning implementation. Falah and Chairuddin's (2022) study provided several shortages wherein access to the internet was the main problem along with teachers' deficiency in experiencing e-learning. So, university teachers are required to update, upgrade with the latest technological setups, and implement blended learning in educational transactions, as supported by studies by Munir et al. (2021), Ashraf et al. (2021), and Kintu et al. (2017).

Educational Implications

1. Students at higher education levels should be provided opportunities for learning through different models of blended learning.
2. Enhanced access to digital devices and increasing digital literacy among institutions teachers and students would ease in implementation of blended learning models.
3. Technological and digital communication infrastructure and greater connectivity between students and teachers should be improved at the institutional level.
4. Orientation Programs must be introduced for institution teachers to incorporate appropriate blended learning models in pedagogical approaches.
5. Changes in the part of curriculum transaction through blended learning models and appropriate allotment of credits should be implemented by the institution.
6. For the implementation of NEP-2020, it is crucial to integrate blended learning models to leverage technology for providing quality higher education to the masses.

Conclusion

Since the pandemic has already paved the way for technology to be a precursor in educational resilience, therefore it becomes imperative for teachers to exploit the plethora of resources available online and offline. Hence, the blended learning hybrid model taps the best of both, i.e. virtual and offline learning. Blended Learning is at its nascent stage. Therefore, university teachers should create appropriate blended learning environments and provide opportunities for students to explore the benefits of hybrid learning strategies.

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Research Article

Online and Offline Internship Experiences of Science Pre-Service Teachers in Delhi: Implications for Teacher Education

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Abstract

The advancement of web technologies and their applications is tremendously changing education around the world, which requires teachers to acquire techno-pedagogical competencies and experiences of it. The present study explored the secondary science pre-service teachers (PSTs) lived experiences of both online and offline teaching in their internship during the third wave of the COVID-19 pandemic. This phenomenological research conducted semi-structured interviews with 14 science PSTs just after their internship. The analysis revealed that participants got oriented and familiarised with using the technologies to explore more ways of teaching and had meaningful experiences despite the challenges they faced. The study highlighted the significance of school students' interaction in developing participants' pedagogical competencies and for the effective teaching and learning process both online and offline. The study recommended the strategies of blending online and offline internships to develop the science PSTs' techno-pedagogical competencies to facilitate the digital transformation in education.

Keywords: Internship experiences, Online teaching, Offline teaching, COVID-19, Science pre-service teachers

Introduction

Internship is essential because it develops the Pre-Service Teacher (PST)'s professional identities, social interactions and pedagogical practices (Caires et al., 2012). An internship programme is where the knowledge of subject content, pedagogy and technology are connected, and PSTs can practically apply it in the actual classroom (Ismaeel & Al Mulhim, 2022). A productive and meaningful internship experience is significant for every PST. The advancement of web technologies has the potential to continuously change the face of education. The COVID-19 pandemic made it obligatory for teacher education institutions to use digital platforms to provide internship experiences to future teachers. The crisis created an opportunity for PSTs to have their internship in online mode, which requires new skills and self-efficacy. Even though online internships are not common in many countries, many studies have documented the challenges and opportunities of an online internship and called for teacher education programmes worldwide to incorporate more space for online internships.

In the post-COVID-19 pandemic era, online courses will proliferate at all levels of education. Hence, teacher education curriculum must be reviewed regularly to ensure it can develop the PSTs' competencies relevant to the emerging education scenarios. The National Education Policy 2020 (MHRD, 2020) of India envisioned digital transformation in education and stressed integrating technologies to improve education at all levels. Further, it proposed bringing new technologies (artificial intelligence,

machine learning, blockchains, smart boards, handheld computing devices, adaptive computers, etc.) to the teaching and learning process as well as to the assessment. Hence, the technological competencies of future teachers are essential for integrating technology into their pedagogical subjects. Science teachers, in particular, must have techno-pedagogical competencies due to the subject's numerical and practical nature. It will enable the science teachers to provide their students with quality hands-on and experiment-based learning experiences.

Understanding PSTs' online internship experiences will help the teacher education curriculum and policymakers to know the potentials and pitfalls of online internship environments and further strengthen them through necessary modifications. In this context, the study aims to understand the secondary science PSTs' both online and offline teaching experiences in schools during the third wave of COVID-19 in Delhi, India. The information gained from this study will benefit teacher education programmes by providing the appropriate training and adjustments to future teachers during their internship program to handle the students both online and offline.

Review of related literature

To effectively engage in the online teaching and learning process, the teacher requires the knowledge of integrating technology and pedagogy to specific content. The sudden change from the traditional mode to distance online education during the COVID-19 pandemic was not smooth for many teachers, students and other stakeholders. The lack of techno-pedagogical competencies among teachers and PSTs has often been stated in many studies conducted in India (Tabassum, 2022; Kamel & Illiyan, 2021). Teacher education institutions in India offer a specialised paper on Information and Communication Technology (ICT) to enhance the PSTs' professional capacity in fulfilment of the National Curriculum for Teacher Education (2014) norms and regulations. However, Tabassum (2022) stated that one of the significant challenges faced by the PSTs during their virtual internship was a lack of training in choosing appropriate pedagogical techniques to teach mathematics in online classes. Moreover, PSTs learned theoretical aspects of different pedagogy from their teacher education course; however, it was not sufficient to teach on the online platform (Iradel et al., 2021). It indicates the gap in teacher preparation programs, as it ignores the importance of incorporating the teachers' technological skills with professional competencies.

Annamalai et al. (2022) pointed out that PSTs developed a negative experience towards online teaching due to students' lack of participation in online learning as they had insufficient digital infrastructure. Bansal et al. (2019) mentioned a discrepancy between teacher education orientations and school internship experiences. The limited infrastructure facilities at Indian schools also challenge the PSTs to engage a constructivist approach in their teaching and learning process, which was expected from the teacher education course. During the pandemic time, the challenges were acute due to limited digital infrastructure.

Cavanaugh et al. (2009) claimed that student interaction is the key to an effective online class. However, studies (Al Abiky, 2021; Bunyamin et al., 2021; Tabassum, 2022; Yusnilita, 2020) highlighted that student had low motivation in the online learning environment, which challenged the PSTs' practice. Especially, PSTs found it difficult to cope with students' diversity

in learning (Tabassum, 2022). Brinia and Psoni (2021) asserted that a lack of interaction between the teacher and students contributed to the low engagement level in online learning. Iradel et al. (2021) explained that the PSTs had trouble in adjusting and managing the online class as they were majorly prepared for face-to-face. In addition, time management was another obstacle faced by PSTs during their virtual internship (Dhimmar & Patel, 2023; Waters & Russell, 2016).

Avsar Erumit et al. (2021) surveyed PSTs' beliefs towards online science education, and they found a negative belief towards the online platform, as it was not appropriate for the practical nature of subjects. Further, PSTs faced difficulties assessing the student's progress on online platforms due to limited training (Al Abiky, 2021; Iradel et al., 2021; Tabassum, 2022). Iradel et al. (2021) propounded that PSTs should be trained for the rapidly changing learning styles and online modalities.

Despite many challenges, the online internship helped the PSTs to develop their pedagogical and technological skills (Pepito, 2022) with a supportive system from teacher education institutions (Iradel et al., 2021). A study conducted by Annamalai et al. (2022) revealed that online practicum increased the PSTs' confidence level in teaching and facilitated active learning. Similarly, Yusnilita (2020) study found that online classes provide more flexibility for students to work collaboratively and reduce the learning gap during the crisis (Kamel & Illiyan, 2021). Moreover, PSTs mentioned in a study by Avsar Erumit et al. (2021) that online education supports their teaching with various materials, which could be easily accessible through the proper platforms. Regarding the effectiveness of virtual internships, Waters and Russell (2016) mentioned that online teaching gave a more realistic image of teaching for PSTs. Similarly, Theelen et al. (2020) recommended the virtual internship for teacher education as it helps in reducing PSTs' anxiety in teaching.

Nevertheless, Ismaeel and Al Mulhim (2022) argued that the traditional face-to-face teaching practice would help PSTs adopt proper teaching methods in the actual teaching context. Ismaeel and Al Mulhim (2022) conducted a survey to compare the traditional and online internship experiences of 120 PSTs during a pandemic. The study concluded that a traditional internship is generally better than an online internship as per the Technological Pedagogical Content Knowledge (TPACK) model. Further, the study suggested blending the traditional and online internships to develop the PSTs' skills to integrate the technology and pedagogy in the given teaching context.

Besides, online internship facilitates a range of opportunities for pre-service teachers. It gives limited scope on real school experiences and a grip on their learning experiences. Many studies have been associated with the challenges and opportunities of the online internship. The present study tries to understand the secondary pre-service science teachers' lived internship experiences, where they had both online and offline teaching experiences. It represents the gap in the literature that the current research aims to address.

Research Methodology

This qualitative study used phenomenology research. "A phenomenological study describes the common meaning for several individuals of their lived experiences of a concept or a phenomenon" (Creswell & Poth, 2016, p.75). It was considered most appropriate for this study since it focused on the lived experiences of science PSTs during their internship. Purposefully selected 14 secondary

science PSTs from the Department of Education, University of Delhi, for the academic year (2020-2022) participated in this study. Given that, due to the third wave of COVID-19 and hazardous air pollution levels that caused subsequent lockdowns in Delhi, they had a few weeks of simulation followed by both online and offline teaching experiences as per their allotted school requirements in their 16-week internship period (between November 2021 to February 2022). Nine of them were males, and five were females. Table 1 details the type of schools where the science PSTs were placed for their internship.

Table-1: Type of schools where the science PSTs were placed for their internship

Type of School	Government	Government-aided	Private	Kendriya Vidyalaya
Science PSTs	P1, P3, P4, P7, P8, P12, P13, P14	P6	P2, P5, P9, P10	P11

At the beginning of data collection, consent to participate in this study was obtained from the participants. Semi-structured interviews were conducted with the science PSTs after completing their internship programme. Interviewees' anonymity is ensured by using the initial letter of the word "Participants (P)" and a number from 1 to 14.

Creswell and Poth's (2016) steps in the phenomenological analysis were used to analyse the data. First, the researcher's judgments and prejudices were kept aside to not to affect the analysis process. Second, the relevant quotes from the participants' textual descriptions were identified. Third, the relevant topics were grouped into themes to give meaning. Fourth, the textual descriptions were written, and verbatim quotations were added to discuss the meaning of the science PSTs' experiences. Fifth, the structural descriptions were written to identify the true essence of the phenomenon. Further, to represent the participants' teaching experiences accurately, they were asked to validate the findings.

Findings

Challenges

Lack of infrastructure

The science PSTs who practised in government schools struggled to conduct online classes due to the unavailability of devices (e.g., smartphones, laptops) and limited accessibility of good internet connections among students. These technology barriers minimalised the science PSTs' online teaching experiences and influenced their pedagogical approaches. For example, P7 stated:

> I thought to use Socrative quiz and all other online apps to teach science. However, students did not have devices. They could not join and participate. That is why I did not use those apps. I just posted PPTs, videos and images in WhatsApp.

To ensure effective teaching for students learning in that difficult time, participants made YouTube videos on their own and posted them in WhatsApp groups. However, the inaccessibility of technology and the overload of online assignments affected poor students' participation and learning. P1 underlined:

> Even though online learning was just through discussion via WhatsApp, the number of participants was meagre. We got a few responses for our videos, homework and worksheets, which the Delhi government gave.

Also, the science PSTs faced problems in conducting activities during offline classes due to a lack of lab and other basic facilities in government schools.

Students' less motivation in learning

The science PSTs stated several problems concerning students' lack of previous knowledge, varied levels of students' participation while doing activities, higher class students' non-participation in discussions, and irregular attendance, which affected the teaching-learning process. The lack of contact between the school system and students reduced their motivation for online learning. The science PSTs did not have enough time and opportunities to develop a good rapport with the students, so they faced challenges in managing both online and offline classrooms. P8 pointed out:

> When I was teaching the concept number of image calculation for the 8th class, I noticed that students did not know odd and even numbers, so I started explaining what odd and even numbers are. So, I did not complete the lesson plan.

and P4 stated:

> Every day, I saw 5 or 6 new students' presence, so mostly, I revised and was not able to continue the chapter.

One big problem stated by the participants was that students were copying answers from online sources during assessment. Hence, science PSTs faced the problem of assessing the student's understanding level in learning during their teaching. Due to access and technological barriers, participants could not ask students to open their cameras and see their reactions during the teaching and learning process. P2 explained:

> If I ask certain things, what do you think about them? Students searched the definitions on Google and spoke. Sometimes, their answers were beyond their comprehension level. So, when I asked for an explanation, they were blank and unaware. This was the case in online classes.

and P6 added:

> Students who participated in regular classes did more cheating. They just copied the answer from online sources without Mindy. So, the assessment was a major problem in getting them to understand.

Science PSTs' fewer opportunities

The participants who practised in private schools had few opportunities to practice the different pedagogical approaches and to teach in a regular class. Mostly, they just revised the topics during extra class time. For instance, P10 mentioned:

> We only got a few extra periods for practice, which are not compulsory for the students to attend. So, we interacted with only a few students. We did not get school cooperation and exposure of other activities like assembly, making time tables, sports etc.

Most of the time, the participants were

informed about the content to be taught just before the day or just a few hours ago. So, they did not get enough time to plan the pedagogical approach, homework, or assessments for that lesson and discuss them with their respective pedagogy teacher.

Overcoming hardships

Adopting interactive tools

The science PSTs got opportunities to develop their pedagogical and technological skills in both online and offline platforms. Their varied pedagogical approaches were based on the topic, the class level and the mode of the classes they got. Mostly, participants used the lecture cum discussion method in online classes (in the platform like google meet and zoom). They made PPTs, images, and YouTube videos. Additionally, they incorporated Graphics Interchange Format (GIF) and 3D images in their teaching to get students' full participation and tried to connect science with their everyday life experiences.

Some science PSTs with enough infrastructure (e.g., laptop, internet connection) and opportunities have used various online apps that are freely available to teach specific topics. They found that those learning apps gave the students real experiences, helped them understand the complex concepts better, and increased their curiosity to learn more about it beyond the textbook content. For example, P6 stated:

> I introduced students to the Stellarium mobile app, saying it is like a personal telescope; you can install it on mobile. The next day they just searched the whole galaxy, observed the International Space Station and asked many questions about it. So, ICT tools were handy to engage students more.

Similarly, P8 mentioned:

> I used one video, a kind of GIF, to show the students how the light passes through their pupil and lens and how it forms an image on the retina. It was a successful method because I took the test of 10 things to recognize from the human eye. They could able to recognize what the retina and optics are. So, they were able to understand because of the video.

and P11 detailed:

> I want to teach beyond the textbook content, so I tried one virtual trip with the 7th class to teach about water conservation. I showed a 360^{0} view of Stepwell in Gujarat through the Google Arts and Culture app. I also used Zygote body (3D anatomy atlas) to teach 'The Respiratory system' to the 11th class students. I showed them how actually the lungs are placed and the functions of the heart, muscles and skeleton. I used that app because I could remove each part one by one so that students could see the internal and external anatomy of the human body.

Additionally, P7 explained:

> *To teach the 'Sound' concept, I used* YouTube videos to help students understand different sounds. First, I played sounds like trumpet, harmonium and guitar. Then I asked them questions. They answered correctly. It was also kind of an assessment. Students liked the videos and participated well.

Moreover, participants mentioned that teaching through online platforms enables them to show or cite real-time examples that are not available in textbooks to connect science with the student's experiences and make them

think about it. For instance, P11 stated that,

> To teach water-related problems, I showed recent newspaper clippings and video of the Chennai and Mumbai floods. Further, I asked the students what do you think about the flood problem? What do you think about urban planning? How do we plan a city? students responded to those.

Also, participants used various assessment apps like Kahoot, Quizizz and Google Forms to asses students' learning at the end of the classes. They also did some activities with students during offline classes.

Students' curiosity in learning

All the participants stated that students' interests and curiosity contributed much to the teaching and learning process. The science PSTs' most liked part of the internship was interaction with the students in offline class as it helped them understand their needs. Students' curiosity in doing activities, questions and answers during discussions motivated the science PSTs to improve their teaching strategies. P11 cited his experience with students in discussion as their lesson progressed:

> In teaching the 'Why do we fall ill?' chapter in class 9th, I had to explain prevention and treatment. So, I kept citing many examples related to COVID-19. Students were asked many questions about COVID-19 and oral and breast cancer. They might be willing to know about that. All their questions were addressed.

Support system

The science PSTs pointed out that feedback and suggestions from their regular/rotational supervisors during simulation teaching and internship were constructive in developing their lesson plans, managing the classroom and practical teaching during difficult times. Peers' appreciation and feedback gave them confidence in teaching. P9 underlined:

> During blended mode class, I got suggestions from my supervisor and peers like paying equal attention to all sets of students, the vocabulary I should use, keeping less text in PPT, sequence of lesson planning and the necessity of connecting the concepts. Those helped me to develop my confidence in teaching. In the later classes, my supervisor complimented my efforts.

Similarly, P7 stated:

> My supervisor appreciated how the chapter 'Reaching the Age of Adolescence' was taught. In those classes, girls participated more in the discussions, which went well. It gave me confidence in teaching.

Accomplish success

Feeling of Satisfaction

The science PSTs felt satisfied with their teaching practice despite the challenges. They felt happy when they saw that students had learned from their instruction. The third wave of COVID-19 created an opportunity to learn and practice more online pedagogy to teach science. Those experiences developed their skills to manage to teach both online and offline during difficult times.

P13 stated:

> My experience was great with students. They were very interactive, very encouraged and curious to inquire about things. I learnt a

lot, especially how to manage and cater to the class's needs, even in difficult times.

and P14 added:

> It was a good experience; we want to learn how to use and progress with the developing technologies. We learned and explored a lot of apps and interactive class forms. I enjoyed the company of peers and had good online and offline teaching experiences.

Meaningful learning

The participants mentioned that their internship experience was enriching since they developed many skills like time management, giving autonomy to students in learning, and practising open-mindedness and reflective thinking based on their experiences at school. P14 underlined:

> Initially, my lesson plan was short, and my supervisor pointed out that my teaching style led to rote learning. I have reflected on why I was doing that. The reason that I comprehended was that my learning experiences at school as a student influenced me greatly. Later, I developed my teaching skills through more activities.

and P2 mentioned:

> I have learned from my peers' classes that we should give students space to pose questions. So, that they will learn. The classes should not be monotonous, it should be interactive.

Moving ahead

The teaching experiences of PSTs have led them to provide a few suggestions to improve the internship programme. They suggested improving the infrastructure facilities and opportunities for proper training at schools. Further, they added that the teacher education programme should include demonstrations of pedagogy teachers' teaching by using different pedagogical approaches with the school students and more training on peer observation and reflective journal writing. Continuous feedback from their supervisors was also requested, along with financial support during their internship. For example, P14 stated:

> It is challenging to engage students based on child-centered educational theories. I want to see our pedagogy teachers' teaching style to learn how to use different constructivist teaching methods.

Discussion

Based on the experiences from the first and second waves of the COVID-19 pandemic, the secondary science PSTs in this study were also trained to teach online. The findings revealed that limited digital infrastructure restricted the participants' online teaching practices. This result is in agreement with many recent studies (Annamalai et al., 2022; Bunyamin et al., 2021; Pepito, 2022; Tabassum, 2022), which suggested providing sufficient digital infrastructure facilities for students and teachers to maximize online teaching and learning like the findings of Bansal et al. (2019), the participants in this study underlined the need to develop school infrastructure facilities and ample opportunities for constructivist practice and learning. Also, they have been asked for financial assistance

during their internship, as suggested by Tabassum (2022).

One of the study findings highlighted that the student's lack of previous knowledge and irregular participation placed the science PSTs in a difficult position to develop confidence in their efforts to continue the online teaching. This may be attributed to the findings of Bunyamin et al. (2021) and Yusnilita (2020), who claimed that the COVID-19 pandemic created a learning gap and decreased the students' interest in learning, which challenged the PSTs to continue their teaching. Waters and Russels (2016) suggested improving the PSTs' communication skills to motivate the students to learn in an online environment. Like Tabassum's (2022) finding, the study disclosed that the online platform had some constraints in tracking the students' genuine learning and progress. Al Abiky (2021), Iradel et al. (2021) and Tabassum (2022) suggested developing the skill set among PSTs to assess the student's performance in the online environment.

Many challenges have significantly affected the participants' facilitation of practice teaching. This study's findings highlighted that meaningful input from the pedagogy teachers in developing lesson plans and supervisors' and peers' advice and suggestions during simulation classes were helpful for improvement. The participants also received feedback after teaching in the actual classroom for further improvement. Similar to Iradel et al. (2021) and Ugalingan et al. (2021) findings, the encouragement and support from teacher education institutions and students' curiosity helped the participants in their meaningful practice as they tried out varied strategies in online teaching.

Unlike Tabassum (2022) finding, the participants used different technological tools/applications that were readily available to them to maximize the students' learning, indicating their advanced techno-pedagogical skills. This also confirmed the previous findings (Dhimmar & Patel, 2023; Ismael & Al Mulhim, 2022) that online internships facilitated the PSTs to use various technological applications to present the content and develop their skills to integrate technology and pedagogy. Participants were satisfied with the learning apps and other teaching-learning platforms as they facilitate collaborative learning. Avsar Erumit et al. (2020) study also suggested incorporating more training on web-based applications such as web 2.0 tools and virtual labs to support students' learning in science.

Moreover, the students' participation in online discussions, activities and quizzes motivated the science PSTs to adopt various strategies to teach science. It supports the notion that students' engagement is critical for developing pedagogical competence among PSTs (Rospigliosi, 2020). Like Pepito's (2022) findings, the science PSTs in this study were promptly accommodated in an online environment. Further, they developed the skill of time management and how to facilitate the students' autonomy for effective teaching and learning during their internship. Figure 1 illustrates the challenges, overcoming hardships, accomplishing success and their suggestions observed from the science PSTs' online and offline internship experiences.

Figure-1: Challenges, overcoming hardships, accomplishing success and suggestions observed from the science PSTs' online and offline internship experiences

Challenges	Overcoming hardships	Accomplish success and suggestions

• Lack of digital and physical infrastructure in government schools
• Limited access to digital devices and poor internet connection at home
• Lack of opportunities in private schools
• Students' lack of previous knowledge and their irregular participation
• Students' less motivation to learn in online classes
• Classroom management
• Difficulties in assessing students' learning in an online environment
	• Adopting various technological tools/ applications to teach science and to do assessment
	• Students' curiosity in learning
	• Support and feedback from teacher educators (pedagogue, supervisors) and peers
		• Meaningful learning (online and offline teaching, time management, students' needs, students' autonomy and reflective thinking)
		• Suggestions
		  • Proper training at schools
		  • Teaching demonstrations from a pedagogy teacher
		  • Training on peer observation and reflective journal writing
		  • Financial support
		  • Continous feedback from supervisors

Overall, the study's findings indicated that science PSTs developed and used their techno-pedagogical competencies in their teaching. However, in agreement with Avsar Erumit et al. (2020), this study finding also revealed that the science PSTs' online teaching experience was not up to the level of offline teaching experience as it eased the interaction with students (Brinia & Psoni, 2021) to realize their problems and understand the functions of the schools' system. Similarly, Ismaeel and Al Mulhim (2022) and Theelen et al. (2020) argued that online internships were ineffective in developing the PSTs' skills of reinforcement managing students and their problems. Further, they asserted the importance of providing offline teaching experience to develop PSTs' pedagogical content knowledge for actual classroom teaching. Finally, virtual internships can be used as peer-to-peer training or positive models to reduce the PSTs' anxiety as suggested by Theelen et al. (2020). Similar to Ismaeel and Al Mulhim (2022), this study suggested adopting blended teaching internships to develop the PSTs' skills to meaningfully integrate technology, pedagogy, and content into their teaching for future education.

Conclusion and Implication

The science PSTs in this study had very distinctive internship experiences. The study findings witnessed that technologies facilitate science PSTs to explore more ways of teaching, and they got familiarised with new technologies. They developed the skills to use various technological applications and handle the students in the online class, which they would not have developed in an offline internship setting. Hence, teacher education courses should pay more attention to the practical aspects of integrating technologies into the teaching and learning process to equip PSTs with more subject-specific tools.

At the same time, offline teaching experiences are also significant since they provide opportunities to understand students' diversity in learning and facilitate interaction with students, which flourished the PSTs' pedagogical competencies. Thus, the study propounded a blended internship mode to prepare highly qualified

teachers for more effective online and offline teaching and learning. In order to enrich the PSTs' competencies, more constructive feedback and interaction with the supervisors need to be strengthened in the new educational environment. Teacher education programmes in India and elsewhere need to examine the chances and challenges of the blended internship mode for further improvement.

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Research Article

Effectiveness and Efficacy of Online Undergraduate and Post-Graduate Courses in India: A Pre-emptive Analysis

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Abstract

The Indian education system is in a state of transition. National Education Policy 2020 of India has envisaged leveraging technology to enhance the reach and efficacy of education. In line with the same, in 2023, University Grants Commission (UGC) of India, which is the apex institution for governing higher education, has given permission for 57 Indian Universities to commence online graduate and postgraduate courses. Karnataka has become the first state in India to actively implement a National Education Policy and leverage technology to enhance the learning experience. In this regard, the study aims to identify and analyze the factors which influence the effectiveness of technology in improving learning outcomes among graduate and postgraduate students in Karnataka.

Keywords: National Education Policy 2020, UGC, Online Education, Graduate Students, Postgraduate Students

Introductıon

Indian Education System is in a much-needed phase of transition. This transition needs to address both the quality and quantity concerns of the Indian Education System. When it comes to quality issues, according to a recent report of Times Higher Education (THE) Rankings (2023 Edition), among the top 500 Universities in the world, India shares only 5 Universities, the best being the Indian Institute of Science, which was in 251-300 band. Furthermore, according to Quacquarelli Symonds (QS) World University Rankings (2023 Edition), none of the Indian Universities were able to feature in the top 150. In the top 500, only 9 Universities have managed to make a place for themselves, again, the best being the Indian Institute of Science, which had secured 155th rank. These metrics reflect that, on the quality front, Indian Universities have a great deal of scope for improvement.

According to the recent Indian Census, which was conducted in 2011, only 8.15 per cent of the Indian populace were graduates, and 4.15 per cent of the Indian populace were postgraduates. So, even when it comes to quantity, India has a long way to go to address the educational needs and requirements of its populace. This is all the more important because India is in the phase of encashing its demographic dividend. 62.5 per cent of the Indian population are in the age group of 15-59 years. According to the Economic Survey 2018-19, the demographic dividend of India is expected to peak by around 2041, when the share of the Indian working-age population (20-59) is expected to be around 59 per cent.

If proper measures are not undertaken in time to train the burgeoning young populace of India, then India's demographic dividend might as well become a demographic liability for the nation. Understanding and acknowledging the crucial importance of education for Indian youth, the Central government of India brought about the National Education Policy in 2020, with an aim to address the quality and quantity concerns of the Indian educational System and to make necessary structural, administrative and organisational changes. In fact, National Education Policy 2020 has stressed a great deal about the possibilities of leveraging technology to address the quantity and quality concerns of the Indian Education System.

In line with the same, in January 2023, University Grants Commission (UGC) of India, which is the apex body for governing higher education, gave permission for 57 Indian Universities to run online graduate and postgraduate courses in India. Among Indian states, Karnataka has become the first state to implement National Education Policy 2020. Before full-fledged online classes are started, we wanted to estimate and identify the various factors which may impact the efficacy of online learning among graduate and postgraduate students in the state of Karnataka. Hence, the present study was undertaken.

Literature Review

According to Goundar and Bimal (2022), most of the studies pertaining to online learning in recent times have been set in developed countries of Asia and Europe. So, there is a need to understand the feasibility of online learning in a developing country like India. To identify the relevant variables which needed to be considered for our study, we tried to understand the various variables which were taken for consideration by previous researchers who had worked to analyze the efficacy of online learning among students pursuing higher education. Based on the review of the literature, the prominent variables which we were able to identify were as follows:

Gender: Based on previous literature, we observed that the role of gender in determining the usefulness of technology among students is a bit vague. Some empirical studies (Upadhayaya et al., 2021; Sitala Khan et al., 2023;) pertaining to online learning among undergraduate students noted that gender did not have any statistically significant association with the usefulness of technology. Furthermore, studies (Paris, 2004; Singh,2021) conducted among senior secondary students also did not observe any statistically significant association between gender and the usefulness of technology in enhancing their learning outcomes.

However, some other empirical studies (Singh & Riza, 2022) did find gender to play a statistically significant role in how undergraduate students perceived the usefulness of technology in enhancing their learning outcomes.

Nature of residence: One of the other variables affecting the usefulness of technology is the nature of residence. Kumar et al. (2022), in their study, which focused on analyzing the effectiveness of ICT among rural and urban graduate students pursuing higher education in India, found that urban graduate students were more adept in leveraging technology to enhance their learning outcomes as opposed to rural students. Another study conducted by Upadhayaya et al. (2021) among undergraduate students of Nepal also came to the conclusion that the nature of residence had a prominent impact on the graduate student's perception of the usefulness

of technology. Furthermore, another study undertaken by Surapuramath, (2021) during COVID time also asserted the role of place in affecting the usefulness of technology among students. Even in a much more recent study, which was undertaken during the post-pandemic period by Papadaki et al. (2023), the researchers have noted that environmental and cultural aspects had a significant influence on the usefulness of technology.

Gadgets: From the available literature we were not able to derive any conclusive view as to which of the digital tools were more effective in enhancing learning outcomes. Ullah and Khan (2017), in their empirical research, observed that personal computers did not have any significant association with enhancing the learning outcomes of students pursuing higher education. However, another study undertaken by Cross et al (2019) pertaining to e-learning among graduate students observed a positive correlation between handheld digital devices and improvement in their learning efficacy. In another empirical study undertaken by Kumar & Rangappa (2021), the researchers observed that smartphones were more useful in enhancing the learning outcomes of rural students and tablets were more useful in enhancing the learning outcomes of urban students.

Applications: With regards to evaluating the efficacy of applications in enhancing learning outcomes, through our literature review, we couldn't find any negative association. So (2016) conducted a controlled group study among undergraduate students who had enrolled in a Teacher's training institute in Hong Kong. Through his empirical study, he inferred that the group which used WhatsApp exclusively for study purposes fared much better than the group which had used WhatsApp for generic purposes. Sözen & Guven (2019) conducted a study among undergraduate geography students, and they observed that online tools for assessment were viewed favourably by the study group. Further, Rajan (2021), through his research, inferred that a mobile learning application termed "Mel app" enhanced the efficacy of learning outcomes among e-learners.

Educational Stream: From our review of previous studies, we were able to note that even the stream of students in question played a significant role in determining their efficacy with technology. Bhuvaneswari, A. S. & Padmanaban, T. (2012), through their study, observed that there was a definite difference in the attitude of arts and science students with regard to the usefulness of technology in learning. Vajravelu and Tammy (2016), through their empirical study, inferred that ICT enhanced the learning outcomes of students studying Calculus. Another study conducted by Kumar et al. (2022) in rural India observed that, among graduate and post-graduate students pursuing Arts, Science and Commerce, students pursuing Science were more adept in using ICT to enhance their learning outcomes as opposed to students pursuing Commerce or Arts. Further, another recent study conducted by Sitala Khan et al. (2023) also observed that there was a significant difference in the attitude between the undergraduate students of Arts and Science with regard to the perception of the usefulness of technology in enhancing their learning outcomes.

Infrastructure: From our review of previous studies, we were able to infer that ICT infrastructure played a prominent role in enabling students to effectively use technology. For instance, Katyetova (2023), in her study in Kazakhisthan observed that ineffective ICT infrastructure in Kazakhistan reduced the efficacy of online learning outcomes among students. Furthermore, other studies (Keskin et

al.,2022; Bawaneh & Malkawı.,2023) have also asserted the importance of infrastructure in facilitating e-learning.

Educational Level: Another prominent variable which seems to influence e-learning outcome of students is the students' educational level. Keskin et al. (2023) in their study observed that undergraduate students were not satisfied with online learning. On the other hand, Omar et al. (2021) in their study observed that undergraduate students were satisfied with online learning.

Demographic Factors: Shia et al. (2006) and Upadhyaya et al. (2021) in their respective studies pertaining to online learning, observed that demographic features like school type, ethnicity and the like did not play any significant role with regards to students' perception of online learning.

Community Based Learning: Physical isolation of students from other students is one of the problems with online learning platforms. Studies which have reflected on this issue have observed that structured discussion (Tibi, 2018) among teachers and students along with moderated discussion among students (Tibi, 2018; Rehman et al., 2023) helps in enhancing their e-learning outcomes.

In our research design, we have made an effort to inculcate most of the prominent variables observed in previous studies.

Research Desıgn & Methodology

There are several studies which have tried to evaluate the efficacy of online learning at global level and in India. Global studies (Lederman, 2020; Swan et al., 2020; Voloshinov, 2020; Opara, 2023) pertaining to online learning have substantiated that online learning does have the potential to enhance the learning outcome of students.

Even in the context of India, there are several studies (Kumar & Rangappa 2021; Kumar et al., 2022; Sitala et al., 2023; Khan et al., 2023) which have made an attempt to evaluate the efficacy of online learning. Some of the studies (Thakkar & Joshi, 2017) have supported online education's potential to supplement offline learning whereas some studies (Namreen & Panakaje, 2022) have observed the absence of proper ICT infrastructure in India to facilitate full-fledged online learning. India is a land of extremes; what is true in the context of India can be equally untrue. Particularly in the backdrop of our research premise, one needs to note that:

National Education Policy (2020) was envisaged to leverage technology to enhance the learning outcomes of students across India. In this backdrop University Grants Commission has given permission for 57 Universities to run full-fledged online graduate and postgraduate courses in India. Full-fledged online learning is a recent phenomenon in India whose waters are yet to be tested. There is scarcity of research pertaining to efficacy of full-fledged online learning in India. As Karnataka became the first state in India to implement NEP, we conducted our research in Karnataka.

We have undertaken our study to aid the government and educational institutions in drawing a better framework for designing and implementing online graduate and postgraduate courses. The preliminary objectives behind our undertaken research are as follows:

1. To identify the socio-economic and technological factors which are affecting the usefulness of technology among students.
2. To assess as to which educational stream is more favorable for implementing full-fledged online learning.

3. To assess the efficacy of graduate and postgraduate students across technological parameters pertaining to online learning.
4. To analyze the formulated objectives, the corresponding hypotheses formulated for the undertaken study are as follows:

Hypothesis 1. Both socio-economic factors and technological factors affect the usefulness of technology in enhancing students' learning outcomes.

Hypothesis 2. Online learning may not be equally effective for all educational streams.

Hypothesis 3. The efficacy of Graduate and Postgraduate students is likely going to differ across different technological parameters pertaining to online learning.

Sampling and Data Collection

The set objectives of our study were to identify and analyze the factors which could influence online learning among graduate and post graduate students in the state of Karnataka.

Profile of the Study Area: Karnataka is one of the economically stronger states of India. Despite being the third richest state in terms of State Gross Domestic Product (2023), Karnataka does have glaring intra-regional inequalities. Due to the presence of extreme intra-regional inequalities in its various districts, we can, to some extent, to understand the efficacy of online learning across economically diverse districts based on the incidence of poverty.

Research Methodology: The research methodology for this study focuses on understanding the efficacy of online learning across districts in Karnataka, stratified by poverty incidence, using the 2021 Multidimensional Poverty Index (MPI) from NITI Aayog. The districts selected represent varying levels of poverty: Bangalore and Mysore for the lowest poverty incidence, Davangere and Chitradurga for average poverty incidence, and Yadgir for the highest poverty incidence. Proportional sampling was employed to ensure that the number of respondents reflected the population size of each district according to the 2011 Census. A total of 570 graduate and postgraduate students were surveyed, with 400 respondents from Bangalore and Mysore, 130 from Davangere and Chitradurga, and 40 from Yadgir. The graduate-to-postgraduate ratio was set at 2:1, mirroring national education trends, with 380 undergraduate students and 190 postgraduate students being included in the sample.

Data was collected through questionnaires administered in person by the researcher, ensuring consistency and accuracy in responses. The survey was conducted at various universities and colleges, including Bangalore University, Bangalore City University, Don Bosco Institute of Management, St. Francis College (Bangalore), Government First Grade College (Mysore), Davangere University, and Government First Grade Colleges and Post Graduate Centers in Chitradurga and Yadgir. The questionnaire focused on key aspects of students' experiences with online learning during the COVID-19 pandemic, including access to technology, quality of online content, learning outcomes, and overall satisfaction.

The sampling methodology was designed to ensure a representative sample across districts with different poverty levels. Data analysis involved using of statistical tools to compare factors like accessibility, student engagement, learning outcomes, and satisfaction with online learning across the selected districts. Ethical

considerations were prioritized, with informed consent obtained from all participants, confidentiality maintained through anonymized data, and voluntary participation ensured, allowing respondents the freedom to withdraw from the study at any time. This approach has tried to ensure a comprehensive understanding of the impact of socio-economic disparities on online learning in the state of Karnataka.

Empirical Analysis

First objective

The first objective of our study was to understand the various socio-economic factors which affected the ability of the students to leverage technology to enhance their learning outcomes. From tables 1, 2, 3 and 4 we have made an attempt to understand as to which of the socio-economic and technological factors have their influence on students' ability to leverage technology for enhancing their learning outcomes.

Table-1: Significance of association between socio-economic factors and usefulness of technology

Usefulness of Technology / Socio Economic Factors		Low	Medium	High	Total	Fishers' Exact /χ2 P-Value
Gender	Female	34	145	146	325	χ2 7.34 P-Value: 0.025*
		(50.75)	(63.88)	(52.90)	(57.02)	
	Male	33	82	130	245	
		(49.25)	(36.12)	(47.10)	(42.98)	
	Total	67 (100.00)	227 (100.00)	276 (100.00)	570 (100.00)	
Place	Bangalore Urban	29	80	105	214	Fisher's Exact P-Value: 0.000**
		(43.28)	(35.24)	(38.04)	(37.54)	
	Mysore	24	71	91	186	
		(35.82)	(31.28)	(32.97)	(32.63)	
	Davangere	10	52	29	91	
		(14.93)	(22.91)	(10.51)	(15.96)	
	Chitradurga	01	17	21	39	
		(01.49)	(07.49)	(07.61)	(06.84)	
	Yadgir	03	07	30	40	
		(04.48)	(03.08)	(10.87)	(07.02)	
	Total	67 (100.00)	227 (100.00)	276 (100.00)	570 (100.00)	

Caste	Scheduled Tribe	02	09	05	16	Fisher's Exact P-Value: 0.531
		(02.99)	(03.96)	(01.81)	(02.81)	
	Scheduled Caste	17	40	52	109	
		(25.37)	(17.62)	(18.84)	(19.12)	
	Other Back-ward Caste	34 (50.75)	121 (53.30)	135 (48.91)	280 (50.88)	
	General (Poor)	00	01	02	03	
		(0.00)	(00.44)	(00.72)	(00.53)	
	General	14	56	82	152	
		(20.90)	(24.67)	(29.71)	(26.67)	
	Total	67 (100.00)	227 (100.00)	276 (100.00)	570 (100.00)	
	Absent	19	111	109	239	χ^2 10.26 P-Value: 0.006**
		(28.36)	(48.90)	(39.49)	(41.93)	
	Present	48	116	167	331	
		(71.64)	(51.10)	(60.51)	(58.07)	
	Total	67 (100.00)	227 (100.00)	276 (100.00)	570 (100.00)	

*Note. *p<.05, **p<.01*

From Table 1, we can observe that, among students, nearly 52 per cent of girls found technology to enhance their learning outcomes.

Interestingly, when it came to place, from our research we were able to infer that students who were belonging to districts like Bangalore and Mysore, found technology to be highly effective in enhancing their learning outcomes. This does seem logical as districts of Bangalore and Mysore do have better ICT infrastructure as compared to rest of the districts.

To the readers who are not well versed about the societal dynamics of India, we need to point out that, when it comes to caste categorization, people belonging to the General category are held in high esteem in the social hierarchy, followed by people belonging to the General (Economically Weaker Section), Other Backward Castes, Scheduled Castes and Scheduled Tribes. Through our research, we were able to infer that the caste of the student did not play any statistically significant role in determining the usefulness of technology. Further, through our research, we were able to infer that the students who had a separate room for studying found technology to be highly useful in enhancing their learning outcomes. In Table 2, we have made an attempt to analyze which of the digital devices were more beneficial for the students in leveraging technology to enhance their learning outcomes.

Table-2: Significance of the association between digital gadgets and the usefulness of technology

Usefulness of Technology / Digital Gadgets		Low	Medium	High	Total	Fishers' Exact /χ2 P-Value
Mobile	Not Using	05	06	06	17	χ2 5.36 P-Value: 0.069
		(07.46)	(02.64)	(02.17)	(02.98)	
	Using	62	221	270	553	
		(92.54)	(97.36)	(97.83)	(97.02)	
	Total	67 (100.00)	227 (100.00)	276 (100.00)	570 (100.00)	
Tablet	Not Using	67	225	269	561	Fisher's Exact P-Value: 0.251
		(100.00)	(99.12)	(97.46)	(98.42)	
	Using	00	02	07	09	
		(00.00)	(00.88)	(02.54)	(01.58)	
	Total	67 (100.00)	227 (100.00)	276 (100.00)	570 (100.00)	
Personal Computer	Not Using	65	222	263	550	Fisher's Exact P-Value: 0.316
		(97.01)	(97.80)	(95.29)	(96.49)	
	Using	02	05	13	20	
		(02.99)	(02.20)	(04.71)	(03.51)	
	Total	67 (100.00)	227 (100.00)	276 (100.00)	570 (100.00)	
Laptop	Not Using	57	200	228	485	χ2 2.96 P-Value: 0.227
		(85.07)	(88.11)	(82.61)	(85.09)	
	Using	10	27	48	85	
		(14.93)	(11.89)	(17.39)	(14.91)	
	Total	67 (100.00)	227 (100.00)	276 (100.00)	570 (100.00)	

*Note. *p<.05, **p<.01*

From table 2, we couldn't derive any statistically significant inference between the relationship between digital gadgets and usefulness of technology. In table 3, we have made an attempt to understand as to which of the digital applications normally used by students were more useful for them in leveraging technology to enhance their learning outcomes.

Table-3: Significance of association between digital applications and usefulness of technology

Usefulness of Technology / Digital Applications		Low	Medium	High	Total	Fishers' Exact /χ2 P-Value
YouTube	Not Using	10	17	45	72	χ2 9.13 P-Value: 0.010*
		(14.93)	(07.49)	(16.30)	(12.63)	
	Using	57	210	231	498	
		(85.07)	(92.51)	(83.70)	(87.37)	
	Total	67 (100.00)	227 (100.00)	276 (100.00)	570 (100.00)	
Educational Websites	Not Using	13	27	39	79	χ2 2.47 P-Value: 0.290
		(19.40)	(11.89)	(14.13)	(13.86)	
	Using	54	200	237	491	
		(80.60)	(88.11)	(85.87)	(86.14)	
	Total	67 (100.00)	227 (100.00)	276 (100.00)	570 (100.00)	
Educational Applications	Not Using	40	96	118	254	χ2 7.05 P-Value: 0.029*
		(59.70)	(42.29)	(42.75)	(44.56)	
	Using	27	131	158	316	
		(40.30)	(57.71)	(57.25)	(55.44)	
	Total	67 (100.00)	227 (100.00)	276 (100.00)	570 (100.00)	
Video Applications	Not Using	16	48	68	132	χ2 P-Value: 0.645
		(23.88)	(21.15)	(24.64)	(23.16)	
	Using	51	179	208	438	
		(76.12)	(78.85)	(75.36)	(76.84)	
	Total	67 (100.00)	227 (100.00)	276 (100.00)	570 (100.00)	

*Note. *p<.05, **p<.01*

From Table 3, we can observe that among digital applications, YouTube and Educational websites had a statistically significant relationship with regard to the usefulness of technology among students. Interestingly, Video conferencing apps and educational websites were not found to have any statistically significant impact on enhancing the learning outcomes of students. In Table 4, we have made an attempt to analyze which other technological factors enhanced the impact of technology in enhancing the learning outcome of students.

Table-4: Significance of association between other technological factors and usefulness of technology

Technology Other Digital Factors \ Usefulness of		Low	Medium	High	Total	Fishers' Exact /χ2 P-Value
Coverage	Bad	12	33	25	70	χ2 26.62 P-Value: 0.000**
		(17.91)	(14.54)	(09.06)	(12.28)	
	Satisfactory	31	108	89	228	
		(46.27)	(47.58)	(32.25)	(40.00)	
	Good	24	86	162	272	
		(35.82)	(37.89)	(58.70)	(47.72)	
	Total	67 (100.00)	227 (100.00)	276 (100.00)	570 (100.00)	
Access of Electricity	Bad	05	13	10	28	χ2 18.28 P-Value: 0.001**
		(07.46)	(05.73)	(03.62)	(04.91)	
	Satisfactory	24	91	68	183	
		(35.82)	(40.09)	(24.64)	(32.11)	
	Good	38	123	198	359	
		(56.72)	(54.19)	(71.74)	(62.98)	
	Total	67 (100.00)	227 (100.00)	276 (100.00)	570 (100.00)	
Device(s) enhances Learning	No	18	41	12	71	χ2 72.79 P-Value: 0.000**
		(26.87)	(18.06)	(04.35)	(12.46)	
	Maybe	33	101	81	215	
		(49.25)	(44.49)	(29.35)	(37.72)	
	Yes	16	85	183	284	
		(23.88)	(37.44)	(66.30)	(49.82)	
	Total	67 (100.00)	227 (100.00)	276 (100.00)	570 (100.00)	
Ownership of Device	Internet Café	05	00	05	10	Fisher's Exact P-Value: 0.005**
		(07.46)	(0.00)	(01.81)	(01.75)	
	Neighbour	01	01	07	09	
		(01.49)	(00.44)	(02.54)	(01.58)	
	Student's Family	16	63	68	147	
		(23.88)	(27.75)	(24.64)	(25.79)	
	Student	45	163	196	404	
		(67.16)	(71.81)	(71.01)	(70.88)	
	Total	67 (100.00)	227 (100.00)	276 (100.00)	570 (100.00)	

*Note. *p<.05, **p<.01*

From table 4, we can observe that there is a statistically significant relationship between network coverage and availibility of electricity with usefulness of technology among students. Majority of the students who had access to good network facility (58.70 per cent) and had greater access to electricity (71.14 per cent) found technology to be more useful in enhancing their learning endeavour.

Further, from table 4, we can observe that use and ownership of devices also had statistically significant relationship with usefulness of technology among students. 66.30 per cent of students perceived that digital devices enhanced their learning outcomes. 71.01 per cent of students who owned their own digital devices strongly felt that technology enhanced their learning outcomes.

Second objective

Through our second objective, we wanted to analyze as to which educational stream was more conducive to full-fledged online courses in India. Hence, we tested the significance of the association between educational streams and the usefulness of technology through Chi-square. The results are summarized in table 5.

Table-5: Significance of association between educational streams and online learning

Online Learning Educational Stream		Low	Medium	High	Total	Fishers' Exact /χ2 P-Value
Educational Stream	Arts	21	53	88	162	Fisher's Exact P-Value: 0.001**
		(12.96)	(32.72)	(54.32)	(100.00)	
	Commerce	46	139	159	344	
		(13.37)	(40.41)	(46.22)	(100.00)	
	Science	00	35	29	064	
		(00.00)	(54.69)	(45.31)	(100.00)	
	Total	67 (11.75)	227 (39.82)	276 (48.42)	570 (100.00)	

*Note. *p<.05, **p<.01*

From table 5, we can observe that educational stream did have statistically significant relationship with online learning among students. Particularly students belonging to arts stream (54.32 per cent) strongly believed that online learning could enhance their learning outcomes, which was followed by students belonging to Commerce stream (46.22 per cent) and students belonging to Science stream (45.31 per cent).

Third Objective

Through our third objective, we wanted to assess the efficacy of graduate and post-graduate students across various technological parameters pertaining to online learning. To analyze the same, we constructed a binomial logistic regression model. To test the stability and the reliability of the model, we have relied upon the Psuedo R square, the Hosmer-Lemeshow test for goodness of fit and the Proportion by chance criterion. The results of the reliability tests are summarized in subsequent tables.

Table-6: Stability of the model

Binomial Logistic Regression	Total Number of Observations	570
Log Likeihood=-273.27567	LR χ2 (20)	179.07
	Prob>χ2	0.0000**
	Pseudo R^2	0.2468

*Note. *p<.05, **p<.01*

From table 6, we can observe that, the pseudo R square of our model is 0.24. According to Mcfadden (1977, p.35), if the value of Pseudo R square is in the range of 0.2 to 0.4, then the constructed model is supposed to the Pseudo R square are presented in Table 6, we can infer that our model has a ble 6, we can infer that our model has good fit.

Table-7: Case Processing Summary

Case Processing Summary			
Educational Level	Categorical Outcome	Number of Observations	Marginal Percentage
	Under Graduate	380	66
	Post Graduate	190	33
	Total	570	100

The accuracy of the model can be checked by Proportion by chance criterion.

The benchmark accuracy of our model is estimated to be:

1.25 * {(0.66*0.66) + (0.33*0.33)} = 0.694 or 69.4 per cent

Table-8: Estimated accuracy of the Model

Observed Outcome	Predicted		
	Graduate (0)	Postgraduate (1)	Percentage Correct
Graduate (0)	338	42	88.9
Postgraduate (1)	99	91	47.9
Overall Percentage			75.3

From table 8, we can observe that, the estimated accuracy of our model is 75.3 per cent, which is greater than the estimated accuracy of our model i.e., 69.4 per cent. Thus, it implies that the prediction of our model is reliable. The estimation of our binomial logistic regression model is presented in table 9.

From Table 9, we can observe that Students belonging to the science stream are more likely to pursue a master's, followed by students belonging to Commerce and students belonging to Arts. When it comes to gender, girls are more likely to pursue post-graduation as opposed to boys. Among the students who have independent rooms, they

are more likely to be undergraduate students as opposed to postgraduate students. If students use YouTube more frequently to learn, they are more likely to be undergraduate students rather than postgraduate students. On the other hand, if the students are using educational apps and educational websites, they are more likely to be postgraduate students. Furthermore, if students find educational websites more useful, they are more likely to be postgraduate students.

Table-9: Estimation of Binomial Logistic Regression Model (Undergraduate student is taken as base reference category)

Education Level (Base Undergraduate Students)	Coeffecient	Std. Err.	z	p>|z|
Education Stream Coded	1.020651	0.1971537	5.18	0.000**
Gender	-1.222171	0.2297383	-5.32	0.000**
Caste	-0.122689	0.0954839	-1.28	0.199
IndependentRoom	-0.500189	0.2231010	-2.24	0.025*
Mobile	-0.463535	0.6048716	-0.77	0.443
Tablet	1.240407	0.8447653	1.47	0.142
PC	0.970338	0.5842075	1.66	0.097
Laptop	-0.121342	0.3235700	-0.38	0.708
DeviceOwnerCode	0.365894	0.1998225	1.83	0.067
AvailibilityofElectricity	-0.118763	0.1921091	-0.62	0.536
Youtube	-1.999567	0.4381815	-4.56	0.000**
EducationalWebsites	-0.510924	0.4476940	-1.14	0.254
EducationalApps	0.620659	0.2309380	2.69	0.007**
YoutubeUseful	0.249736	0.1559678	1.6	0.109
Educational WebsitesUseful	0.718548	0.1532507	4.69	0.000**
Video Conferencing Apps Useful	-0.142563	0.1152581	-1.24	0.216
Readingway	0.390279	0.2362956	1.65	0.099
Devices Enhanced learning	0.169491	0.1771462	0.96	0.339
Technical Problems inonlineclass	-0.26543	0.2158786	-1.23	0.219
Usefulness of Technology	-0.045167	0.1789673	-0.25	0.801
_cons	-1.089080	0.8490684	-1.28	0.200

*Note. *p<.05, **p<.01*

Hypothesis 1

Both socio-economic factors and technological factors affect the usefulness of technology in enhancing students' learning outcomes.

Through our study, we were able to ascertain that, socio-economic and technological factors did affect the extent to which technology was useful in enhancing the learning outcomes of students.

Pertaining to social factors, gender, place and independent room were found to be affecting the usefulness of technology among students.

With regards to gender, we found that girls are more likely to be effective in leveraging technology for enhancing their learning outcomes. Hence, they would benefit more from online courses as opposed to boys.

With regards to place, Bangalore and Mysore were found to be more conducive for implementing online courses. Incidentally, Bangalore and Mysore have the lowest incidence of poverty along with high-tier ICT infrastructure. So, in this backdrop, the extent to which online learning can help in addressing regional imbalances, particularly with regard to education, is an issue of concern.

With regards to privacy, from our study, we were able to infer that students who had access to independent study rooms were able to effectively use technology to enhance their learning outcomes.

Pertaining to technological factors, we were able to statistically ascertain that digital devices, ownership of digital devices, access to a better networks and availability of electricity enhanced the usefulness of technology in the students' learning endeavour.

Hypothesis 2

Online learning may not be equally effective for all educational streams.

From our study, we were able to infer that students belonging to the arts stream found online learning to be more conducive to enhancing their learning outcome, which was followed by students belonging to the commerce and science streams, respectively.

Hypothesis 3

The efficacy of Graduate and Postgraduate students is likely going to differ across different technological parameters pertaining to online learning.

From the binomial logit model, we were able to infer that graduate and postgraduate students did differ across different technological parameters pertaining to online learning. YouTube format of learning was likely to be more favoured by undergraduate students, and educational apps-based learning was more favoured by postgraduate students. In addition to that, from our study, we were able to infer that educational websites were more likely to be useful for postgraduate students.

Policy Implications

At the beginning of 2023, the University Grants Commission of India took the bold step of giving permission for 57 Indian Universities to run online undergraduate and postgraduate courses. For a vast country like India, in which the graduate and postgraduate populace comprises merely 8 per cent and 4 per cent of the total populace, the initiative undertaken by the University Grants Commission should be deemed commendable. When we observed the courses which were to be taught through online mode, there were courses pertaining to science, arts and commerce streams. Furthermore, the districts in which the Universities were offering the said courses spanned from rich to poor. In India, rich districts are characterized by superior socio-

economic infrastructure as compared to poor districts. In this regard, through the undertaken study, we wanted to analyze how feasible online courses were across different districts of varied economic prosperity, across different educational streams and across students of different educational levels. As the state of Karnataka was the first state in India to implement a new National Education Policy, we chose to conduct our study in the different districts of the state of Karnataka, spanning from districts having the lowest incidence of poverty to districts having the highest incidence of poverty. Through analyzing the students who had undergone at least one semester of full-fledged online courses during the COVID-19 pandemic across different districts of Karnataka, we wanted to analyze the feasibility of the implementation of online graduate and postgraduate courses. The policy implications of our study with regard to the technical, academic and social feasibility of the courses are summarized as follows:

1. **Subsidizing online education for girls**

   In India, there is conspicuous gender divide in among boys and girls in social, economic and academic dimensions. Through our study we noted that the girls were able to leverage technology in a better manner to enhance their learning outcome as opposed to boys. In this backdrop, if girls were to be subsidized by government for online education, it could help in bridging the gender divide and heralding inclusive social development.

2. **Create conducive tele commnication infrastructure in districts with high incidence of poverty**

   Further, when it came to districts under consideration, through our study, we were able to analyze that online education was more conducive to districts like Bangalore and Mysore, which incidentally had the lowest incidence of poverty. Being economically well-off districts, they have better ICT infrastructure. Thus, online learning is bound to be more effective in districts with better ICT infrastructure. Through our research, we were able to ascertain that better network facilities and better availability of electricity enhanced the learning outcomes of students. Thus, to enhance the efficacy of online learning, the government must enhance the infrastructural facilities pertaining to ICT in districts with higher incidences of poverty.

3. **Provide digital gadgets to students**

   Through our research, we were able to infer that the usefulness of technology among students not only depended on using digital devices but also depended on the ownership of digital devices. In this regard, if the concerned state governments could either subsidize or provide credit lines for students pursuing online courses to procure their own digital gadgets, particularly for students who are residing in districts with high incidences of poverty, that initiative could go a long way in enhancing the effectiveness of online learning among students.

4. **Full-fledged online Under-graduate and Postgraduate courses are more conducive for students pursuing subjects of arts stream rather than those of commerce or science.**

   Through our research, we were able to infer that students

pursuing arts or humanities streams felt more comfortable in leveraging technology for online learning as opposed to students pursuing commerce or science. This does seem logical, as teaching theoretical subjects would be easier to teach and learn through online mode. Hence, we would recommend full-fledged online programmes for theoretical subjects rather than technical or lab-oriented subjects,

5. **More interactive online curricula are required for undergraduate students**

   Through our study, we were able to infer that educational apps and YouTube enhanced the learning outcomes of students. Thus, while designing online courses for undergraduate students, it would be better for the Universities to compose relatively more audio-visual-based interactive content rather than just online literary material for students pursuing undergraduate courses. This would enhance the learning efficiency among undergraduate students (Hegeman, 2015; Trespalacios et al, 2020;).

6. **Professional Development for Educators:**

   To ensure the success of online education, there is a pressing need to invest in the professional development of educators. Training programs should focus on effective online teaching strategies, digital pedagogy, and the use of technology in the classroom. Supporting teachers in adopting innovative teaching methods will enhance the overall quality of online courses and improve student outcomes.

7. **Monitoring and Evaluation of Online Programs:**

   Establishing robust monitoring and evaluation frameworks for online courses is essential (Kumar and Rangappa, 2021; Keskin et al, 2023[a]). Regular assessments should be conducted to measure the effectiveness of these programs, identify areas for improvement, and ensure that educational standards are maintained. Feedback mechanisms involving students and educators can provide valuable insights for continuous improvement, ensuring that online education remains relevant and effective in meeting learners' needs.

8. **Incorporating Local Context and Relevance:**

   Online curricula should be designed to incorporate local context and cultural relevance to better engage students (Goundar and Bimal, 2022). By integrating regional examples, case studies, and local languages, universities can make online learning more relatable and effective for students from diverse backgrounds. This approach not only enhances engagement but also fosters a sense of belonging among students.

9. **Promoting Lifelong Learning and Skill Development:**

   Given the rapid changes in job markets and industry requirements, online education should focus on lifelong learning and skill development. Institutions should offer flexible online courses and modules that cater to working professionals and non-traditional students looking to upskill or reskill. Promoting such initiatives can help bridge the gap between

education and employability, ensuring that learners remain competitive in the workforce.

Conclusion and Way Forward

India is a vast and diverse country. Education in India is not just about knowledge, but it is also about social mobility along with a chance of having a better life and livelihood. At the same time, providing quality education for the emerging aspirational middle class is no less a daunting task for the nation and its government. In this regard, commencing full-fledged online courses by traditional universities can not only help provide affordable education for the masses but also help increase the productivity and efficiency of talented and gifted teachers. In this light, the permission provided by India's University Grants Commission for 57 Indian Universities to run full-fledged online graduate and postgraduate courses is truly a commendable step in the right direction. The online courses are supposed to start from the academic year 2023-24 onwards. Our research was a preemptive analysis to evaluate the feasibility of such a program based on the responses taken from undergraduate and postgraduate students who were forced to undergo online courses during the COVID-19 pandemic for at least one semester. Subsequent cross-sectional studies across various regions and states would shed more light on the issues that need to be addressed to enhance the efficacy of such online programs. Regardless of the issues to be ironed out, few would disagree about the potential of online courses to promote inclusive education, particularly in a vast and diverse country like India. Further cross-sectional studies across regions and states will be essential to address any gaps and ensure that online education fulfils its potential to promote inclusive education. While some issues undoubtedly need to be resolved, the potential of online courses to democratize education and improve access for underserved populations in India is widely recognized. In a country as diverse as India, online education holds the promise of expanding opportunities and breaking down barriers, making education more accessible to all.

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Research Article

Understanding Post-Graduate Students' Online Academic Help-Seeking Behaviours in India

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Abstract

In the post-COVID-19 era, the internet has become an integral tool for academia, encompassing teachers, educational researchers, educationists, students, and parents. It is widely utilised to solve various problems, learn innovative concepts in different subjects, and expand knowledge in areas of interest. Specifically, students at different educational levels frequently turn to the internet for assistance in understanding and improving their academic work. This behaviour aligns with the concept of online academic help-seeking, which is often described as a "self-regulating learning strategy" (Newman, 1994). To investigate the online academic help-seeking behaviours of postgraduate students of central universities in India, this study aimed to understand how students seek online academic help to meet their academic needs, which online channels they use, how they utilise these channels to accomplish academic tasks, and whether any external factors influence their online academic help-seeking behaviours. Adopting a qualitative-exploratory design, the study engaged 38 postgraduate students from diverse academic disciplines, selected through purposive sampling. Data were collected via an online questionnaire comprising both closed- and open-ended questions, and analysed using thematic analysis. The findings highlight that online academic help-seeking is a crucial learning strategy, enabling students to address academic challenges and enhance their subject understanding through varied online platforms, depending on their level of internet self-efficacy. However, external factors such as socioeconomic status and language barriers significantly impact students' ability to seek online academic help. The study emphasises the need for educational institutions to address these challenges, ensuring equitable access to online academic resources and preventing any student from being excluded from the benefits of digital learning.

Keywords: Online academic help-seeking, internet self-efficacy, external factors, postgraduate students, higher education in India

Introduction

It is evident that students need guidance and help from their teachers and other sources in order to flourish in their academic lives. However, research studies show that there are a significant number of students in the classroom who feel hesitant to ask their teachers for guidance and support in certain areas. Among different factors, the fear of being alienated from their academically successful peer groups is also one that causes hesitancy (Karabenick, 2003; Peeters et al., 2020; Ryan & Pintrich, 1997). Sometimes, it leads them to be victims of an inferiority complex situation. This hesitation can hinder their learning performance and achievement, as they may struggle to effectively grasp the concepts being taught (Baker, 2017).

The rapid advancement of information and communication technology (ICT) in the era of globalisation has opened up

new possibilities and perspectives for individuals in various sectors (Mäkitalo-Siegl et al., 2011). As a consequence, the internet has become a valuable tool for getting effective assistance and accomplishing tasks efficiently (Comer, 2019). In recent times, it has played a significant role for everyone involved in academia, including teachers, educational researchers, educationists, students, and parents (Mouratidis & Papagiannakis, 2021). It serves as a platform to address a wide range of problems, explore innovative concepts in various subjects, and expand knowledge in areas of interest (Comer, 2019). Through the Internet, students get access to a vast array of online learning resources, platforms, and communities that can provide the help and support they need (Zimmerman, 1990). Online channels such as educational websites, forums, virtual tutoring platforms, and social media networks allow them to seek assistance beyond the confines of the classroom (Cheng & Tsai, 2011). As a result, they can connect with experts, educators, and peers from diverse backgrounds and locations, expanding their perspectives and learning opportunities (Comer, 2019). This behaviour is often described as a *"self-regulating learning strategy"* of the students (Newman, 1994) that promotes independent problem-solving skills, and fosters a sense of autonomy in students' academic pursuits (Newman, 1994; Zimmerman, 1990). It reflects the metacognition and regulation skills of the students (Aleven et al., 2003; Gonida et al., 2019) and provides an alternative approach for them to comprehend topics they may feel uncomfortable asking their teachers about in a traditional classroom setting.

By actively engaging in the self-regulating learning strategy, students can independently seek clarification and support from a wide range of resources available on the internet (Tseng & Chai, 2011). Numerous studies conducted globally have demonstrated a relationship between students' online academic help-seeking behaviours and their internet self-efficacy, which refers to their belief in their ability to exert effort and complete tasks effectively online (Cheng & Tsai, 2011; Ding & Er, 2018). Through online academic help-seeking, students can bridge knowledge gaps, gain new perspectives, and ultimately achieve better academic outcomes (Tseng & Chai, 2011). A study conducted by Ding and Er (2018) found that students with high internet self-efficacy are more likely to navigate online platforms, access appropriate sources of assistance, and effectively accomplish their academic tasks. By leveraging their internet self-efficacy, they can actively seek help and support online, tailoring their learning experiences to their specific needs (Cheng & Tsai, 2011). This empowerment enables them to become independent learners, develop critical thinking skills, and enhance their problem-solving abilities. Hence, it is crucial for students to cultivate their internet self-efficacy and utilise online platforms effectively to maximise the benefits of online academic help-seeking in their learning journey (Ding & Er, 2018).

At present, almost every higher education institution in the world has adopted the blended learning method to encourage learners to be self-regulated (Fan & Lin, 2022). Influenced by this method, students have begun to take online help from different platforms to do well in their academic work (Hao et al., 2017). It is to be mentioned that when there were no provisions for finding adequate quality academic materials in the library, learners faced a lot of problems understanding certain phenomena and matters related to their education, but now they are able to access a myriad of academic readings to be academically self-reliant. This

virtual assistance helps them develop their knowledge and understanding in a broader way in the era of globalisation to become competent in the global academic as well as economic arenas (Ding & Er, 2018).

In a developing country like India, where 68.8 per cent of the total population, or 833 million people, lives in village areas (Census of India, 2011), the influence of online learning among students pursuing higher education is very significant. They are now no longer only accustomed to reading printed texts but are going beyond them (Naik et al., 2021). Since this is an era of globalisation and advanced science and technology where there is no scarcity of quality learning materials over the Internet, students seek online academic help using their internet self-efficacy from different channels to do their studies well (Fan & Lin, 2022). It helps them understand things better and become knowledgeable, productive, and self-reliant.

Literature Review and Research Questions

Student Help-Seeking

When a student asks his/her teacher for clarification about their classroom assignment, this is considered a kind of help-seeking behaviour (Qayyum, 2018). Help-seeking is a cognitive and metacognitive activity that entails a number of acts, such as recognizing the need for assistance, explicitly articulating the difficulties, and formulating inquiries to ask for help (Doebling & Kazerouni, 2021; Newman, 2008). It is a very important component of self-regulated learning (Gall, 1981).

A student can seek both non-academic and academic help (Qayyum, 2018). Non-academic help implies seeking assistance in different fields other than academia, such as administration, personal life, career-building, technology, human relationships, etc. On the other hand, academic help refers to the assistance that students seek from their teachers, peer groups, and other academicians in the field of academia to enhance their learning experiences.

Academic help-seeking behaviours are crucial for students' academic excellence, as they can access support through diverse online and offline channels. Therefore, while defining the concept of academic help-seeking, Qayyum (2018) opines that "it is one among many learning strategies students use to improve their learning, including studying more, organising one's studying, note-taking, outlining notes and readings, reviewing, choosing engaging assignments, and managing expectations, including lowering aspirations" (p. 1). Academic help-seeking is a key behaviour that can help both face-to-face and online students learn more effectively (Qayyum, 2018). It is a process of being aware of the need for assistance, deciding that assistance is required, locating helpers, eliciting assistance, and assessing the assistance (Aleven et al., 2003; Cheng & Tsai, 2011).

There are a variety of factors that affect the decisions of students about their academic help-seeking behaviours, such as the learner's motive (Karabenick & Knapp, 1991), the perception of menace to their self-esteem from aid resources (Karabenick, 2003), and their faith in the resource's utility (Price et al., 2017).

Online Academic Help-Seeking

Online academic help-seeking is described as the spontaneous request for assistance from others over the Internet (Cheng & Tsai, 2011). It refers to getting help using internet resources such as search engines, emails, or online platforms like social network sites and different educational mobile applications with the goal of solving

academic challenges (Hao, 2016). As a result, looking for online material for academic reasons has progressively emerged as a significant sort of help-seeking activity on the Internet (Fan & Lin, 2022). When students effectively utilise their self-regulatory skills to select appropriate online academic resources, they can reap significant benefits, leading to an enhanced learning experience (Doebling & Kazerouni, 2021).

Researchers have looked into how the internet environment might assist learners in improving their aid-seeking tendencies (Mäkitalo et al., 2011; Puustinen et al., 2011). Mäkitalo-Siegl et al. (2011) discovered, for example, that the web-based learning environment had a favourable impact on learners' help-seeking activities, particularly when there was a low degree of guidance on the teacher's part. With regard to online academic help-seeking, Cheng and Tsai (2011) identified three types of student behaviours: (1) information searching (for example, surfing Google or similar search engines for information to address academic issues); (2) formal query (for example, requesting support from teachers or tutors through email); and (3) informal query (for example, making virtual requests for academic assistance to peers or unknown academicians).

Nevertheless, accessing online academic support necessitates internet self-efficacy, as students require confidence in their ability to navigate and utilise digital resources effectively. Without this proficiency, students may encounter difficulties in locating and leveraging suitable online academic help, potentially hindering their academic success.

Internet Self-Efficacy

Internet self-efficacy is commonly defined as a student's confidence in his/her ability or expected outcomes in an Internet-based learning environment (Tsai et al., 2011). Students with a high level of internet self-efficacy performed better in online learning than those with a low level of internet self-efficacy (Kuo et al., 2020). Studies conducted earlier have found that students' internet self-efficacy is directly tied to their prior internet experience (Joo et al., 2000; Wu & Tsai, 2006). When students had a favourable experience in online settings—for example, experiencing constructive criticism or having a sense of success on the Internet—they would possess higher levels of positive confidence and attitude towards utilising the Internet (Chu & Tsai, 2009; Wu & Tsai, 2006). Liang and Tsai (2008) found a significant positive correlation between internet self-efficacy and students' preferences for internet-based learning environments. Specifically, their study revealed that students with higher levels of internet self-efficacy exhibited a stronger inclination towards exploratory learning, preferring to investigate information from diverse sources and engage in online inquiry-based learning activities.

The Surge in Online Learning due to the COVID-19 Pandemic

The rapid advancement of information and communication technologies has significantly transformed the landscape of teaching and learning. The COVID-19 pandemic, which disrupted conventional face-to-face education, compelled thousands of higher education institutions worldwide to cease in-person operations and adopt online learning as a primary mode of instruction (Abdelfattah et al., 2023; Oraif & Elyas, 2021). During this period, online education emerged as the most accessible format for higher education. Students, educators, and researchers were required to swiftly transition to digital platforms, incorporating online courses, virtual classrooms, and electronic textbooks into their academic

routines. This shift demanded that educators exhibit readiness to embrace online learning as a viable alternative to traditional pedagogical methods.

Duffin's (2023) research reveals that 65 per cent of surveyed educators expressed support for integrating open educational resources into their teaching practices, while 63 per cent advocated for competency-based education systems. The global health crisis has underscored the necessity for a transition from traditional teaching approaches—such as lectures, seminars, and laboratory work—toward online education. However, despite the apparent benefits, the adoption of online learning has not been without challenges.

In the context of India, the implementation of online learning is significantly influenced by socio-economic disparities. Research by Goswami et al. (2021) highlights the difficulties faced by socially and economically marginalised groups—such as Scheduled Castes (SC), Scheduled Tribes (ST), Other Backward Classes (OBC), women, and students from rural areas—during the shift to online education. Key barriers include the high cost of high-speed internet, inadequate digital infrastructure, and poor connectivity (Goswami et al., 2021; Ministry of Human Resource Development, 2020). Malo (2021) corroborates these findings, emphasising the disproportionate challenges faced by marginalised students in accessing online education. Additionally, Vashistha et al. (2024) report that students from lower socio-economic backgrounds often lack the necessary experience to effectively use digital devices, further hampering their educational outcomes.

Despite these challenges, many students pursuing higher education in India continue to leverage online resources to enhance their academic performance. However, in this context, there is a dearth of qualitative research exploring how students actively engage with online platforms to improve productivity in their educational pursuits. Recognizing this gap, the present study aims to investigate this underexplored dimension of online learning within the Indian context.

Research Questions

The research questions guiding this study were: How do students pursuing higher education in India seek online academic help to meet their academic needs? What types of 'online channels' (Cheng & Tsai, 2011)—such as e-tutor systems, social networking sites, and other platforms—do they utilise for this purpose? How do they leverage these channels to complete their academic tasks? Additionally, are their online academic help-seeking behaviours influenced by external factors? These questions have been explored through a flexible approach in this research.

Referring to the categorization of online academic help-seeking behaviours proposed by Cheng and Tsai (2011), this study has aimed to understand India's central university's postgraduate students' online academic help-seeking behaviours. The central universities, also known as public universities, are under the responsibility of the Ministry of Human Resource Development (now known as the Ministry of Education), Union Government of India. It was established by an Act of Parliament (Ministry of Human Resource Development, Government of India, 2012). Here, students from different parts of the country come to study, irrespective of caste, religion, gender, or economic condition.

Methodology

Research Design

The study adopted a qualitative-exploratory design to gain a comprehensive understanding of the online academic help-seeking behaviours of postgraduate students at a central university in India. Exploratory research requires a qualitative approach to understanding phenomena (Denscombe, 2003), as it provides in-depth insights, flexibility, and a focus on participants' context and experiences. This approach enables the exploration of underlying reasons and dynamics, contributing to future research and theory development.

Participants

Sample Background and Selection:

The study included a total of 38 postgraduate students as participants. The selection of participants was carried out among diverse academic disciplines within different central universities in India, chosen through a purposive sampling technique.

Table-1: Background of the Participants

Category	Sub-category	Number of Participants (n)	Percentage (%)
Total Participants		38	100
Academic Discipline	Science	11	28.95
	Arts	24	63.16
	Commerce	3	7.90
Socioeconomic Background	Middle Class	25	65.79
	Lower Middle Class	13	34.21
Geographical Location of Participants	Delhi	15	39.47
	Uttar Pradesh	3	7.89
	West Bengal	4	10.53
	Bihar	6	15.79
	Maharashtra	1	2.63
	Assam	8	21.05
	Arunachal Pradesh	1	2.63

Gender Distribution:

Among the participants, 21 were male and 17 were female. This distribution indicates a slight imbalance towards male participants, with males comprising approximately 55.26 per cent of the sample, while females constituted approximately 44.74 per cent.

Age Range:

The participants' ages ranged from 20 to 25 years, corresponding to young adulthood. This stage is considered a critical university developmental age, characterised by developmental tasks focused on experiencing and managing independence and autonomy (Alesi et

al., 2023). This age range was chosen to ensure that the participants were in a similar phase of life, primarily focused on their postgraduate studies. By limiting the age range, the study aimed to minimise potential variations due to significant age-related factors.

Internet Usage Habits:

A significant majority of respondents (74 per cent) reported spending more than 21 hours per week on internet usage, while the remaining proportion (26 per cent) allocated less than 21 hour weekly to online activities.

Data Collection Tools and Procedure

To address the research questions, an online questionnaire was developed to gather pertinent data. The questionnaire comprised a mix of closed- and open-ended items. The closed-ended questions elicited demographic information, including gender, age, academic discipline, geographical location, socioeconomic status, and internet usage patterns, thereby providing a comprehensive participant profile. Conversely, the open-ended questions were designed to facilitate in-depth, qualitative responses, enabling participants to express their thoughts, opinions, and experiences regarding online academic help-seeking behaviours, uninhibited by predetermined response categories. This dual approach yielded a rich dataset, combining quantitative and qualitative insights for analysis.

To facilitate the data collection process, a digital platform was employed, which is a Google Form. Participants were provided with a unique link to the Google Form, which they could access through their internet browser on any device, such as laptops, smartphones, or tablets. Upon opening the link, participants were presented with the questionnaire, where they could read each question and provide their responses in the provided text boxes. This ensured that participants could complete the questionnaire at their own convenience and from any location with internet access. Once participants completed and submitted the form, their responses were automatically received by the researcher.

The data collection period spanned nearly four months, allowing participants sufficient time to respond to the questionnaire. The extended duration ensured that a diverse range of participants could contribute their insights and experiences, potentially enhancing the representativeness of the sample and enriching the data collected.

Data Analysis

This study is grounded in Cheng and Tsai's (2011) categorization of online academic help-seeking behaviours, which served as the foundation for coding the collected data. However, while coding the data, a few additional themes emerged that extended beyond Cheng and Tsai's framework, including the impact of socioeconomic factors on digital access and the influence of language on online academic help-seeking. The participants provided responses in either English or Assamese. Grammatical errors in English responses were corrected, while Assamese responses were translated into English. To capture these nuances, the researcher employed Thematic Analysis (Aronson, 1994), a qualitative research method suited for identifying, analysing, and reporting patterns and themes within data (Javadi & Zarea, 2016). This analysis method helped uncover meaningful insights and understand underlying themes or patterns that emerge from participant responses (Braun & Clarke, 2012). It also allowed to integrate both a priori codes (based on Cheng and Tsai's

(2011) categorization) and emergent themes, providing a comprehensive understanding of students' online academic help-seeking behaviours.

Findings and Discussion

The present generation is living in an era of advanced science and technology. Individuals, from students to teachers, academicians to scientists, businessmen to entrepreneurs, all take advantage of information and communication technology (ICT) to get their stuff done effectively (Player-Koro, 2012; Sarkar, 2012; Uluyol & Şahin, 2014). In this process, the internet—a worldwide system of computer networks—plays a pivotal role, without which it is very difficult to survive in this era (Comer, 2019). The Internet helps us get things done quickly and very effectively with ease, be it academic, personal, social, economic, or business-related issues, etc. (Castells, 2001). This section analyses how and why postgraduate students in India use the Internet for online learning, specifically examining their online academic help-seeking behaviours under various themes.

Information Searching

Information searching is the first category of online academic help-seeking behaviours of a student as classified by Cheng and Tsai (2011). The data that came out of the study paints a great picture of how the students pursuing their postgraduate courses in different subjects at the central universities in India took to the internet to search for information on certain topics to get their doubts clarified and develop their understanding (Bailey & Lee, 2020; Metzger, 2003; Tanveer et al., 2020). A few of their responses in this regard are depicted below, giving them pseudonyms.

Respondent: Anand

> "I use Google most of the time to seek information on different subjects. For example, if I need to know about a certain topic that is not clearly given in the book to which I am referring in my course, I type the keywords in the search engine of Google and get reading materials there. It helps me a lot to clear up my doubts and improve my understanding of the topic."

Respondent: Rohit

> "Sometimes we do not find some information appropriately in books, and for this we have to rely on other sources. To fill this gap, I take help from the internet. Most likely, I use Google, YouTube, and Google Scholar to find the needed information. It saves my time and energy. A student like me greatly benefits from this process."

Respondent: Chahana

> 'When I encounter difficulties downloading articles from Google Scholar, I rely on our university's E-Library system to access necessary reading materials. The E-Library has subscriptions to numerous international publishers and journal databases. If I still face challenges, I supplement my searches using alternative platforms: LibGen, Anna's Archive, Z-Library, ProQuest, DuckDuckGo, and Sci-Hub."

Respondent: Upasana

> "I take help from YouTube videos to understand the topics of my syllabus that seem difficult to me to understand by reading. On YouTube, you are able to find a

lot of academic videos on almost all topics that you want to learn about. It is the best platform for me to understand anything, be it academic or current issues, etc."

Respondent: Anupam

"When I need to learn about a specific topic, I instantly turn to ChatGPT. It provides a comprehensive overview, allowing me to grasp the essence instantly. ChatGPT has been invaluable in clarifying various concepts. Additionally, I utilise ChatGPT to refine my sentence structures for academic writing, which significantly enhances the standard of my language."

Respondent: Dhiraj

"Alongside ChatGPT, I also utilise Meta AI and Gemini for my studies. These platforms prove helpful, but I regularly verify the authenticity of the data they provide, as they occasionally supply inaccurate information."

The platforms (search engines and online resources) used by the participants (students) of the study include widely known ones such as Google, Google Scholar, and YouTube, as well as specific resources like the E-Library of the university, ChatGPT, Meta AI, Gemini, E-Journals, Library Genesis, Anna's Archive, Z-Library, ProQuest, DuckDuckGo, and Sci-Hub. These platforms cater to the specific academic needs of the students, including providing access to scholarly journals, research papers, books, and other resources (Cheng & Tsai, 2011). They offer participants the opportunity to delve deeper into their subjects and obtain critical understanding through reliable and comprehensive materials (Culduz, 2024; Simamora et al., 2020). Although AI chatbots like ChatGPT, Meta AI, and Gemini offer valuable insights, their limitations necessitate careful evaluation (Schei et al., 2024). Students must critically assess and verify information through multiple sources to avoid potential pitfalls, such as outdated data or biased perspectives, ensuring academic integrity and reliability (Annuš, 2024; Dwivedi et al., 2023).

When asked about the availability of study materials on the internet, most participants stated that Western academic books and articles are easily accessible online. However, they noted that the same may not be true for Indian academic resources. In this regard, two participants' responses are given below.

Respondent: Amir

"On the Internet, you can find as many books as you want freely, but most of them are written by foreign authors and published abroad."

Respondent: Preeti

"It's really difficult to download books freely from the Internet that are published by Indian authors in our country. To clarify my confusion regarding certain topics, therefore, I go through Western writers' books. They are easily available on Google."

When selecting online reading resources, participants consider two key aspects: surface-level factors such as title, abstract, and writing style, and credibility indicators like peer-reviewed sources from renowned publishers (e.g., SAGE, Taylor & Francis, Springer) and indexing in databases like SCOPUS, Web of Science, or UGC-CARE. However, some participants expressed concerns about the authenticity of freely available online resources, questioning their reliability without proper in-text citations and peer review (Kankam et al., 2024; Tang et al., 2021). Therefore,

they emphasise the importance of verification, highlighting the need for critical evaluation of online information to ensure academic integrity. Their responses are cited below.

Respondent: Ashish

> "When I need in-depth information on a specific topic, I prefer reading relevant articles. To determine relevance, I review the article's abstract to assess its alignment with my academic needs. If the abstract meets my requirements, I proceed to read the article; otherwise, I discard it. I particularly value articles available online that include proper citations, as this ensures the authenticity and credibility of the information."

Respondent: Sanjana

> "I prefer research journals from renowned publishers like SAGE, Taylor & Francis, and Springer for my academic purposes, particularly those indexed in databases such as SCOPUS, Web of Science, or UGC-CARE."

While most participants reported not facing difficulties in finding information online, a few mentioned encountering challenges. In this case, one of the participants, *Tina*, reveals,

> "Most of the time, I face difficulty getting access to authentic and quality reading materials. Because of this, I get unmotivated to study."

According to Kuo et al. (2020), students' low internet self-efficacy could be the cause of this difficulty. To overcome these challenges, they need guidance from peers or teachers in the classroom on how to find authentic learning materials on the internet (Ong & Quek, 2023).

Formal Query

According to Cheng and Tsai (2011), formal query is the second category of a student's online academic help-seeking behaviours. This category refers to students seeking support and clarification from their teachers or e-tutors through virtual multi-media platforms (Cheng et al., 2013; Lee et al., 2014; Liu, 2017; Martín-Arbós et al., 2021). The communication between the student and the teacher in this context is considered formal (Martín-Arbós et al., 2021).

In the study, participants were presented with a questionnaire that focused on the concept of "formal query" as proposed by Cheng and Tsai (2011). The collected data revealed that most of the students do seek help from their teachers and e-tutors to enhance their understanding of specific topics. When faced with challenges in finding authentic and relevant materials for their subjects, students turn to their teachers for assistance, and the teachers provide them with the necessary support (Doebling & Kazerouni, 2021). From this perspective, the participants responded,

Respondent: Rakesh

> "Sometimes when I don't find appropriate materials on the internet, I ask the subject teacher to provide us with the readings. He/she shares them through email or WhatsApp."

Respondent: Vivek

> "Whenever I have some doubts or queries regarding certain topics, I send texts on my e-teacher's WhatsApp or mail him on the same, seeking support. He or she then shares quality materials over there. It is really very helpful."

In this study, it was found that participants predominantly utilise platforms such as WhatsApp and Email to seek virtual assistance from their teachers. WhatsApp, in particular, provides an instant messaging platform that allows for quick and both synchronous and asynchronous communication, enabling students to receive timely responses and support from their teachers (Bouhnik & Deshen, 2014; Reeves et al., 2019). These communication tools offer convenient and direct channels for students to reach out to their teachers, ask questions, and seek clarifications regarding specific subject matters (Bouhnik & Deshen, 2014; Cheng & Tsai, 2011; Reeves et al., 2019; Sharma et al., 2011). This interaction fosters a supportive learning environment where teachers act as mentors and facilitators, helping students receive timely responses, even when mentors may not be available for immediate face-to-face interaction. It saves time and allows students to make progress on their projects without significant delays.

Few participants mentioned that in cases where a larger group of students faces challenges understanding a particular subject, virtual audio-visual meeting applications like Google Meet and Zoom are commonly employed by teachers. In this regard, one of the study's participants, *Shruti*, says,

> "When we have difficulty understanding certain contents of the syllabus, we ask our teachers to take a class on the same. Sometimes, they take classes in virtual mode using Google Meet or Zoom."

Platforms like Google Meet and Zoom offer features such as video conferencing, screen sharing, and real-time interaction that facilitate effective communication and collaboration between teachers and students (Adenegan & Abiodun, 2018; Wiyono et al., 2021). By leveraging these applications, teachers can conduct virtual classes, hold discussions, and provide explanations in a more interactive and engaging manner. This form of virtual communication facilitates direct and personalised support, enabling mentors to address specific challenges or provide suggestions for improvement (Wiyono et al., 2021). This promotes a sense of inclusivity and allows students to actively participate in the learning process (Nuraziza et al., 2021). Therefore, it can be anticipated that the use of virtual audio-visual meeting applications not only aids in addressing group difficulties but also helps in establishing a friendly rapport between students and teachers.

Furthermore, some participants mentioned that when working on projects or dissertations, they often discuss any issues or challenges they encounter with their mentors through virtual means like WhatsApp, email, or audio-visual meeting applications. One of the participants, *Satish*, responded,

> "I remember that when I was doing my dissertation work, several times I took guidance from my mentor through Email to appropriately analyse the collected data. You can't meet your mentor every day due to his engagement at various works and in this case, online channels like Email or WhatsApp play a significant role."

These platforms provide convenient and efficient channels for students to communicate with their mentors and receive timely guidance and support (Adenegan & Abiodun, 2018; Bouhnik & Deshen, 2014; Reeves et al., 2019; Wiyono et al., 2021). By utilising virtual means of communication, students can benefit from the expertise and guidance of their mentors without the constraints of physical proximity (Sofi-

Karim et al., 2022). They can maintain a continuous flow of communication, seek clarifications, and receive valuable input throughout the project or dissertation process. This virtual engagement fosters a collaborative and supportive relationship between students and mentors, ensuring that students receive the necessary guidance to excel in their academic work (Ratten, 2023).

Informal Query

It is interesting to note that according to Cheng and Tsai (2011), informal queries are identified as the third category of online academic help-seeking behaviours. This category refers to students seeking virtual assistance from their peers or unknown academicians to accomplish their academic tasks in a convenient manner. The data collected through the questionnaire revealed that a significant portion of participants, approximately 82 per cent, engaged in seeking virtual help from their peers or unknown academicians through various online channels. They mentioned several online channels that they commonly use for informal queries, such as Email, Facebook, LinkedIn, WhatsApp, ResearchGate, Academia, Unacademy, and Byju's, among others. They utilise these platforms to connect with subject specialists, authors, and academicians worldwide (Gao, 2022; Lee et al., 2023) . Some participants expressed that they rely on a few of these channels to obtain high-quality research articles that are not freely available on the internet, expanding their access to diverse knowledge sources. In this perspective, Aditi utters,

> "When I am not able to download an essential article for free on the internet, I send a request to its original author on ResearchGate to share it with me. This way, I collect the articles that I want to read for my academic benefits."

The data revealed that participants found value in engaging with global academics through informal queries. A similar finding was also reported in the study conducted by Green (2018). These interactions provided them with insights into the education systems of different countries and valuable information about admission procedures for traditional and professional higher education courses. One of the respondents, Riya, says,

> "For my further studies, I am these days having interaction with different professors around the globe with the help of my LinkedIn account. They show cooperation regarding various aspects of academia. At first, I didn't have any idea how to get admission to a foreign university with a scholarship, but thanks to the LinkedIn platform, I now have some basic ideas regarding the same. It has helped me a lot."

This aspect underscores the significance of connecting learners and teachers from around the world, as it fosters social harmony and contributes to the holistic development of individuals. By interacting with academics from diverse backgrounds and geographical locations, participants gain a broader perspective on various education systems (Zalli, 2024). They can learn about the unique features, approaches, and practices employed in the educational institutions of different countries. This exposure to diverse educational systems enhances participants' understanding of global perspectives and promotes a more inclusive and comprehensive outlook on education. Additionally, participants acquire information about the admission procedures for traditional and professional higher education courses in different countries. This knowledge can be particularly valuable for those considering pursuing further

studies abroad or seeking insights into alternative educational pathways. Engaging with global academics allows participants to gather first-hand information and advice, helping them make more informed decisions regarding their academic pursuits and future career paths (Fabriz et al., 2021).

Participants in the study expressed a strong interest in discussing academic matters with peers from different locations, highlighting the positive impact of such interactions. Engaging in discussions with peers from diverse backgrounds was seen as a valuable opportunity to enhance their understanding of various subjects and academic topics. One of the participants, Ashish, responds,

> "I come across different research scholars on platforms like LinkedIn, Academia, ResearchGate, and Facebook, with whom I can discuss various academic issues. Sometimes, we can collaborate on research papers to get them published in reputed journals."

Another respondent, Aditya, elicits,

> "I use Email and WhatsApp most of the time to convey my basic academic doubts to my Research Supervisor so that I can get clarification within a short span of time."

Interacting with peers from different locations brings together different perspectives, experiences, and knowledge. Participants find that engaging in discussions with peers from diverse backgrounds provides them with new insights, alternative viewpoints, and unique approaches to understanding and tackling academic challenges (Bjøntegaard, 2015; Virkkula, 2016). These interactions broaden their understanding of various subjects, expose them to different methodologies and perspectives, and enrich their overall learning experience. Furthermore, participants emphasise that collaborative work on projects and research papers can be facilitated through these interactions. Working together with peers from different spaces enables them to pool their diverse expertise and resources, leading to more comprehensive and well-rounded outcomes. By combining their knowledge, skills, and perspectives, participants are able to approach academic tasks from multiple angles and produce more robust and innovative work. Collaborating with peers from different locations also fosters valuable cross-cultural exchanges and interpersonal skills that help them learn each other's cultural backgrounds, communication styles, and collaborative practices (Sahadevan & Sumangala, 2021). These interactions enhanced their ability to work effectively in diverse teams, appreciate different perspectives, and develop intercultural competence.

Impact of Socioeconomic Factors on Digital Access

Socioeconomic factors significantly influence students' digital access (Al-Ajeely et al., 2023; Zdravkov, 2024). Specifically, income level, educational background, geographic location, and family structure and resources impact affordability, availability, and proficiency in utilising digital technologies (Joshi et al., 2024). This study revealed that most students from lower-middle-class backgrounds face a digital divide due to their households' low income and poor internet connectivity, both at home and in institutions. This limitation hinders their online learning opportunities, digital literacy development, and ultimately, academic performance, perpetuating unequal educational outcomes (Afzal et al., 2023). The findings underscore the need for targeted interventions. The following responses from respondents

illustrate this concern:

Respondent: Dilip

> "I don't have a laptop for my academic pursuits. Financial hurdles create numerous challenges in accessing quality education."

Respondent: Bidisha

> "I live in a remote village with poor internet connectivity, making it challenging for me to utilise virtual platforms like YouTube, Google Meet, and Zoom, which hampers my online learning."

Studies conducted by Korkmaz et al. (2022) and Muthuprasad (2021) have also reported similar findings, highlighting the need to bridge the digital divide. To achieve this, essential measures such as affordable digital infrastructure, digital literacy programs, accessible educational resources, and community-based initiatives must be ensured. Educational institutions should also play a vital role in this context by providing high-speed internet on campus and adequate computers with subscriptions to renowned publishers and databases (Ministry of Human Resource Development, 2020; Simamora et al., 2020). Research has shown that institutions offering these amenities significantly enhance students' academic performance (Simamora et al., 2020). By addressing socioeconomic disparities and promoting equitable digital access, educators and policymakers can foster an inclusive and supportive learning environment for all students.

Influence of Language on Online Academic Help-Seeking

Language plays an indispensable role in students' academic success (Met, 2008). Proficiency in language significantly affects students' ability to articulate their needs, comprehend online content, and engage with digital learning materials (Ramadan Elbaioumi Shaddad & Jember, 2024). Students whose home language differs from the dominant language of online educational resources may encounter significant obstacles in seeking online academic help. These obstacles can lead to misunderstandings, misinterpretations, or incomplete comprehension of academic instructions. This study's findings support this notion, as reflected in the responses of several participants:

Respondent: Pranjit

> "Having studied in a vernacular medium until graduation, I now face difficulties adjusting to English-language academic materials. Choosing the right reading materials is challenging, and I often struggle to express myself in English. Academic English proves especially daunting."

Respondent: Suchita

> "I face difficulties seeking online academic help due to my limited knowledge of English vocabulary. If reading materials were available in the vernacular medium, I would have benefited immensely."

The excerpts demonstrate that language limitations can deter students from seeking online help, potentially jeopardising their academic success. The National Education Policy 2020 recommends placing special focus on making content available in all Indian languages, ensuring that digital resources reach teachers and students in their respective mediums of instruction whenever possible (Ministry of Human Resource Development, 2020). Research suggests that students from linguistically diverse backgrounds can benefit significantly from:

Multilingual online resources, culturally sensitive support services, and language-specific academic guidance (Kroll & Dussias, 2018). In this regard, teachers, therefore, should receive rigorous training in learner-centric pedagogy and in developing high-quality online content using teaching platforms and tools. The teacher's role should be highly emphasised in facilitating active student engagement with both the content and their peers (Ministry of Human Resource Development, 2020).

Implications for Higher Education

The study focuses on the online academic help-seeking behaviours of postgraduate students at India's central university. The findings suggest that online academic help-seeking is considered a *"self-regulating learning strategy"* (Newman, 1994), which implies that students actively take initiative in seeking assistance to support their learning process. The study highlights the significance of various online channels that students use for help-seeking purposes. These channels are reported to play a crucial role in students' help-seeking behaviours, indicating their importance as valuable resources for academic support (Cheng & Tsai, 2011).

Given the study's findings, higher education institutions can take steps to support and encourage students' use of various online channels for academic help-seeking. They should stay updated with the evolving technological landscape and continually assess the effectiveness and appropriateness of the recommended online channels for academic support.

The higher educational institutions can consider implementing strategies to scaffold and foster students' engagement with these platforms outside the traditional classroom setting so that students gain a better understanding of their academic subjects (Qayyum, 2018). For example, while search engines and online platforms offer quick and convenient access to information, the higher education institutions can help students develop effective search strategies by supporting their digital literacy. This may include using appropriate keywords, understanding search algorithms, and employing advanced search techniques to locate relevant and reliable sources. Students should also be encouraged by their educational institutions to critically evaluate the information they find and ensure its credibility and relevance to their studies.

Students who struggle with English should be made aware of alternative ways to access reading materials in their vernacular medium. In this regard, institutions can prioritise developing content in all Indian languages to ensure accessibility in students' mediums of instruction. Additionally, teachers should receive rigorous training in learner-centric pedagogy and the creation of high-quality online content using teaching platforms (Ministry of Human Resource Development, 2020).

Conclusion and Future Work

The study highlights the importance of online academic assistance as a learning strategy for students. It emphasises that students, based on their internet self-efficacy, employ a variety of online channels to seek help and address their academic concerns. This process not only aids in better understanding the subject matter but also facilitates knowledge expansion. Additionally, it fosters a sense of social harmony among learners and teachers, contributing to overall personality development.

However, this study acknowledges certain limitations, particularly as digital alternatives continue to expand. The primary aim of this qualitative study

was to understand how postgraduate students from Indian central universities seek online academic help to make their learning fruitful rather than to draw broad conclusions. Hence, the findings of the study may not be generalizable to students enrolled in state-run universities or other levels of higher education, such as undergraduate programs. This is a limitation of this study.

To gain a more comprehensive understanding of students' online academic help-seeking behaviours, future studies may encompass diverse levels of higher education, including undergraduate and postgraduate students, in both state and central universities. This broader scope would offer a nuanced understanding of their needs, enabling more targeted interventions to enhance learning experiences.

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Research Article

Design and Implementation of a Yogic Educational Game "Yogapatnam" as a Teaching Tool

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Abstract

The purpose of this paper is to develop and evaluate a mobile educational application that supports children's learning of the theoretical aspects of yoga. This paper describes an educational game application called "Yogapatnam", which is an Android-based Snakes and Ladders game application that aims to be a learning tool with an attractive design that would help children learn basic yogic terms. The methodology of this research includes the study of literature (analysing similar applications for educational purposes), as well as the design, development, and implementation of the application. The application was implemented in 50 school students of 6th-8th grade for 1 month. Students were instructed to use the application on a daily basis as homework. The pre-and post-tests were conducted with the help of a multiple-choice questionnaire comprised of 50 questions related to Yoga education. The scores collected were considered as pre and post data to evaluate the yogic knowledge of the students. The paired t-value was found to be 24.25 at the p>0.0001 level. The results show that the educational game application "Yogapatnam" is an effective learning tool and can be used as a helping tool for learning basic yoga knowledge using an interesting and fun learning concept.

Keywords: School children, Educational game, Yoga education, Android, Yogapatnam

Introduction

The use of technology in the classroom has completely changed how we study and teach a variety of disciplines in recent years. Education technologies have developed steadily over time, from traditional classrooms to digital platforms. Their aim is to improve interaction, engagement, and memory retention. Extending this idea to yoga education, the incorporation of gamification concepts has the potential to completely transform how yoga is instructed and learned. Traditional yoga teaching methods generally lack interactive and engaging components. This gap offers a fertile field for the development of innovative teaching methods that combine the ancient wisdom of yoga with modern educational technologies. This research paper aims to explore the design and implementation of a Yogic Educational Game (YEG) named "Yogapatnam" as a tool for teaching yoga. The YEG has developed a deep understanding of the fundamental principles of yoga and game design, ensuring an immersive and authentic experience for learners.

The YEG was created with a thorough understanding of and simplifying the core concepts of yoga, guaranteeing the learners a unique and genuine experience.

The objectives of this research paper are threefold. Firstly, to investigate the potential benefits of incorporating gamification in yoga education, such as increased motivation, active participation, and enhanced learning outcomes. This research study has three distinct goals. First, look into the possible advantages of gamification in yoga instruction, such as improved learning outcomes, increased motivation, and active involvement. Secondly, the principles of game design that can be effectively applied to the development of the YEG, fostering engagement, interactivity, and knowledge retention will be examined. At last, the effectiveness of YEG as a teaching tool was evaluated by comparing its impact on student learning outcomes. It seeks to empower yoga teachers with an innovative tool that can enhance their teaching methodologies by making yoga more accessible, enjoyable, and effective for students.

Review of related literature

Yau et al. (2022), conducted a systematic review to investigate the efficacy of mobile applications that encourage healthy dietary, physical activity, or sedentary behaviour modifications in children between the ages of 8 and 12 years in order to prevent childhood obesity. From January 2008 to July 2021, MEDLINE, Embase, PsycINFO, CINAHL, and ERIC were all thoroughly searched for peer-reviewed primary papers. The majority of the 13 studies that were found (n=8, 62 per cent), employed a quasi-experimental design. There were observed significant increases in BMI (2/6, 33 per cent studies), nutritional outcomes (5/6, 83 per cent studies), physical activity (4/8, 50 per cent studies), and diet (Yau et. al., 2022).

Since kids are among the most susceptible to disaster damage, the educational game Ludo Disaster Alert was created to help kids become more prepared for disasters. It was put into practice at Setonorejo Kras Elementary School as a disaster alert education technique. Pre-experimental research was conducted utilising the one-group pre-test post-test design approach. The 20 students aged 8-9 years were included in this study. Before playing the instructional Ludo disaster alert game, 40 per cent of students fell into the category of almost prepared; however, after playing it, there was a rise in preparation, with 55 per cent of respondents falling into the category of really prepared. There was a significant difference between the pre and post-instructional game Ludo Disaster Alert, with a significance value of p=0.05 (Kurniawati & Astuti, 2023).

The analysed study contrasted the effects of using the MalMath application versus the conventional method of teaching mathematics on students' academic achievement. A quasi-experimental investigation was carried out using a sample population of 72 students. The students of the experimental MalMath group performed better academically (45.11) than the students in the control group (33.23), which was statistically significant (Shurygin et al., 2023).

The purpose of this study was to determine whether game-based learning and mobile learning may be used in teaching accounting. A total of 46 students took part in the training. Before the instructions began, a pre-test was given to the students. A post-test was given following the introduction of the game-based mobile learning approach. The findings demonstrated

that for every item, the post-test scores were significantly higher than the pre-test values. It suggests that mobile learning through games can enhance learning results (Kao et al., 2023).

The reviewed study aimed to determine whether adding ChordIQ, a digital program, to music teaching would enhance students' academic performance. A test of 25 theoretical questions and 25 practical exercises was created to evaluate academic performance. By computing the student's t-test using the "Test Score" and "Missed Classes" parameters, the groups were compared. According to the data gathered, the experimental group's mean score was 87.50 out of 100, but the control group's was significantly lower at 65.37. Compared to the control group, individuals in the experimental group were also proficient in the singing practice known as solfeggio (Ouyang, 2023).

The study evaluates the usability of a mobile game-based learning application called Rory's Math Adventure (ROMAAD) in improving the mathematical abilities of Year 4 primary students. It has 18 levels, which can be played without an internet connection. Evaluation of usability was carried out from the viewpoint of 37 school students. The evaluated 5 constructs were ease of use, ease of learning, consistency, information structure, design and satisfaction. The study concludes that ROMAAD is an effective educational mobile game for teaching Year 4 mathematics in game-based learning, with the potential to improve students' mathematical skills, computational thinking, motivation, active participation and interest (Annamalai et al., 2022).

This reviewed study by Kuznetcova et al., 2023, proposed a new direction of VS (visuo-spatial) training focusing on the development of visuo-spatial self-efficacy (VSSE), or one's confidence that they could complete specific VS tasks. To implement and assess the effectiveness of a game-based VS intervention for middle school students, a quasi-experimental design with 169 students as samples by using purposive sampling. The 96 participants in the experimental group played the intervention game during 4 sessions over the course of 2 weeks, while the 73 participants in the control group engaged in typical class activities. The results revealed that the intervention significantly increased students' VS self-efficacy but not their VS performance or STEM performance (Kuznetcova et al., 2023).

The idea of this research paper is to design and develop a mobile game-based yoga learning tool. The reviewed literature indicates the use of various mobile-based games in teaching various subjects or topics, which proves the effectiveness of educational mobile games. However, we did not find any such game for the theoretical aspect of yoga. Like other subjects, there is a need to develop digital yoga teaching aids that may help introduce basic yoga terminologies to school children using a simple and play-based method.

Need of the study

There are many applications available for yoga, such as "Kids Yoga at Home - NH Fits", "Yoga for Kids and Family Fitness", "Yoga for Kids", and "Yoga for Kids Teenager Workout". However, all these apps focus only on the practical aspects of yoga, i.e., asanas, pranayama, and meditation. Though these are very important, another side of the coin, i.e., the theoretical aspect, is missing in these apps. After learning theory, practising yoga may make the children perfect. The benefits of yoga should not be limited to asanas alone; it is a part of life and approaches us in a holistic manner. According to NCERT

(2012), yoga could be introduced from the elementary (primary) level onwards, i.e., secondary and senior secondary, in informal ways (https://ncert.nic.in/dess/pdf/yoga.pdf). This kind of application can be used to convey the essence of our yogic scriptures in an interesting and interactive way so as to make children eager to learn about our traditional knowledge. Mobile applications based on yoga can help attain the goal of incorporating yoga, i.e., traditional knowledge systems, in school education, as directed by NEP (National Education Policy, India), 2020. Using mobile apps for yoga education may help students learn with ease and improve their ability to use technology. With the help of yogic mobile game applications, children will be able to learn and understand the basic concepts of yoga in an interesting way. It will also enhance value-based education among the new generation. These apps can become powerful teaching aids in yoga education for teachers.

Application development and design

Steps followed by the developer for Application development:

Step 1: Create a new Unity project and name it "SnakesAndLadders".

Step 2: Create a new scene in the project and name it "GameScene".

Step 3: Create a 3D plane object in the scene and scale it to 10x10x1. This will serve as the game board.

Step 4: Create a 3D cube object and scale it to 1x1x1. This will serve as the player's token.

Step 5: Create a script named "PlayerController" and attach it to the player's token. This script will handle the movement of the player.

Step 6: In the PlayerController script, create a variable to store the current player position on the game board.

Step 7: Create a method in the PlayerController script to move the player based on the result of a dice roll. The method should update the player's position and move the token to the new position on the game board.

Step 8: Create a script named "GameController" and attach it to an empty game object in the scene. This script will handle the game logic.

Step 9: In the GameController script, create a list of all the snakes and ladders on the game board. Each item in the list should contain the start and end positions of the snake or ladder.

Step 10: Create a method in the GameController script to check if the player has landed on a snake or ladder. If they have, the method should move the player to the end position of the snake or ladder.

Step 11: Create a UI canvas in the scene and add a button to roll the dice.

Step 12: Create a script named "DiceRoller" and attach it to the roll dice button. This script will handle the dice roll.

Step 13: In the DiceRoller script, generate a random number between 1 and 6 to simulate a dice roll.

Step 14: In the DiceRoller script, call the move player method in the PlayerController script with the result of the dice roll.

Step 15: In the GameController script, create a method to check if the player has won the game by landing on the last square of the game board.

Step 16: Add a win condition to the game by displaying a message on the screen when the player wins.

Step 17: Test the game and make any necessary adjustments to the code or game mechanics.

These steps provide a basic outline for

creating a Snakes and Ladders game in Unity.

Game design:

After following these steps, this is the design of the game:

1. The designed and developed game is a special kind of game application similar to the traditional S&L game. It can be called a Yogic Snakes and Ladders game. It is an Android-based application, and it is a serious game. Serious games are those that serve purposes other than entertainment, such as educational, political, advertising, exercise etc. The average size of the app is about 18 megabytes and it is an offline game. The player does not require internet access after downloading it once. So, it is very easy to use and access. This is a two-player game, and one piece is green, and the other one is blue. The players get a hint above the board about whose turn it is.
2. While playing any level, the player may have the option to pause, replay the level, or go to the home page. There is also pleasant background music that is optional to play or not (fig. 1).

Figure-1: Options in between the game

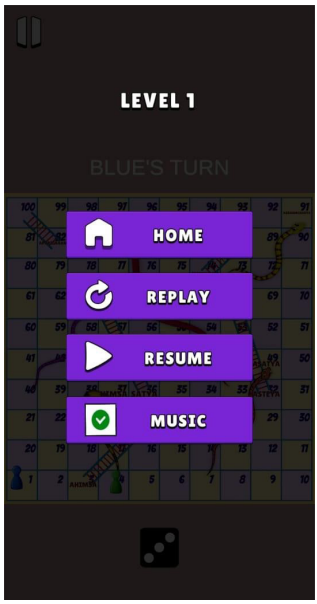


Figure-2: Home page

3. The Snakes and Ladders game is divided into 7 levels (fig. 2) and only after passing the previous level players are allowed to promote to the next level. The number of yogic terms increases as per the level. The squares with ladders represented the yogic practices / moral values helpful in the yogic path, while the squares with snakes represented evils or things that act as obstacles in the yogic path as well as in normal human life.
4. Whenever the player reaches either snake or ladder, there opens a dialogue box with a yogic term. The player gets enough time to read the term. After that, the player is shifted to the other end of the snake or ladder and another dialogue box opens with the meaning of that yogic term (figs. 3 &4).

Figure-3: Dialogue box with yogic term

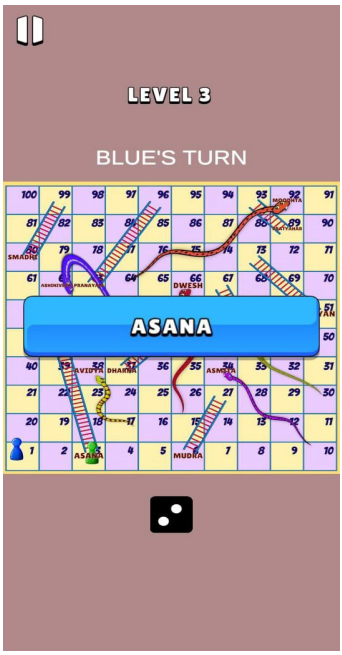
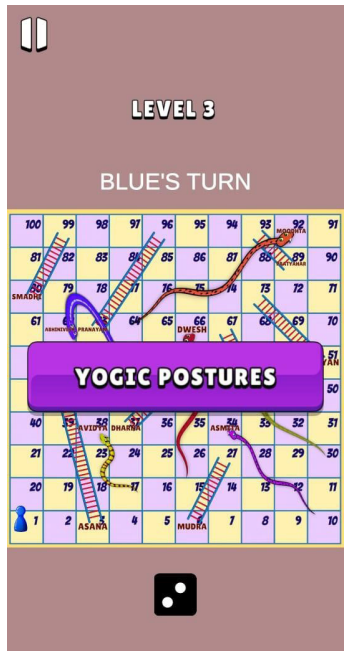
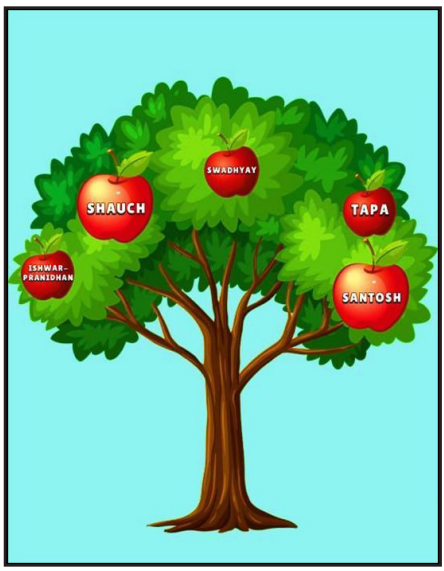


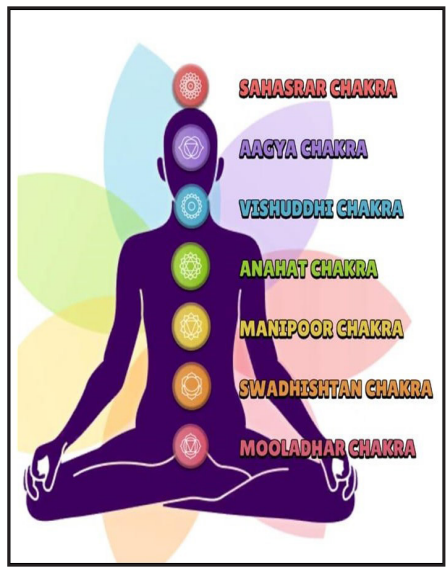
Figure-4: Dialogue box with the meaning of the yogic term



At the end of each level, there is a screen with a tree having some fruits. The fruits are named after the positive yogic activities that the players learned at the level. This will help the players to remember the yogic terms collectively (figs. 5&6).

Figure- 5&6: Summary of levels





Yogic terms and their meanings in the levels of game:

Level 1

Ladders		Meaning
Ahimsa		Not to harm anyone by body, mind and speech
Satya		Truthfulness
Asteya		Non-stealing
Brahmcharya		Celibacy/Move into Brahman consciousness
Aparigraha		Not to possess unnecessary things

Snakes		Meaning
Himsa		To harm anyone by body, mind and speech
Asatya		Non-truthfulness
Steya		Stealing
Abrahmcharya		Not to move into Brahman consciousness
Parigraha		To possess unnecessary things

Level 2

Ladders		Meaning
Shauch		Hygienic mind, body and speech
Santosh		Satisfaction
Tapa		Willingness to go through adverse situations
Swadhyay		Listening, understanding and implementation of knowledge
Ishwar-Pranidhan		Faith in God

Ladders		Meaning
Ashauch		Unhygienic mind, body and speech
Asantosh		Non-satisfaction
Atapa		Being into comfort zone
Aswadhyay		Not to take knowledge from anywhere
Nastikta		No faith in God

Level 3

Ladders		Meaning
Asana		Yogic postures
Mudr		Symbolic gestures, posture to channelize the pranic energy
Bandh		Postures in which we lock the flow of energy
Pranayam		Controlled breathing
Pratyahar		Inward senses/ full control on senses
Dharna		Concentrating on a particular object
Dhyan		Meditation/ unbroken flow of concentration
Smadhi		Meditator and the object of meditation integrate into the one single identity

Snakes		Meaning
Avidya		Lack of knowledge
Asmita		Feeling of me and mine
Raag		Deep attachment towards the things which give happiness
Dwesh		Strong dislikes or hatred towards the things which give sorrow or pain
Abhinivesh		Fear of death
Moodhta		Foolishness

Level 4

Ladders		Meaning
Utsah		A strong feeling of excitement
Sahas		Ability to face difficulties
Dhairy		Ability to remain calm in adverse situations
Tatva gyan		Knowledge of the reality
Nishchaya		Firm determination
Jansang ka tyag		To avoid spending too much time with other people

Snakes		Meaning
Ati-ahar		To eat more than necessary
Prayas		Excessive working
Prajalp		Excessive speaking
Niyamagraha		Bound in restrictions
Chanchal mana		Unstable/ scattered mind
Jansang		To live around many people

Level 5

Ladders		Meaning
Balanced mooladhar chakra		Energetic, physically fit and strong
Balanced swadhishtan chakra		Creativity, enthusiasm, joy, bliss, passion
Balanced manipoor chakra		Strong self-esteem, Sense of self and life's purpose Healthy metabolism
Balanced anahat chakra		Love, compassion
Balanced vishuddhi chakra		Clear speech, singing ability, balanced & calm thoughts
Balanced aagya chakra		High concentration, wisdom, ability to discriminate between real and non-real
Balanced sahasrar chakra		Strong nervous system, spiritually blessed, open minded, feel connected to universe

Snakes		Meaning
Imbalanced Mooladhar chakra		Anxiety, depression, insomnia, digestive issues
Imbalanced Swadhishtan chakra		Urinary disease, infertility, allergy, negativity, addiction
Imbalanced Manipoor chakra		Diabetes, obesity, lack of confidence and motivation
Imbalanced Anahat chakra		Heart disease, asthma mistrust, anger, revenge
Imbalanced Vishuddhi chakra		Anxiety, lack of freedom, restriction, thyroid and throat problems, speech disorders
Imbalanced Aagya chakra		Lack of decision making power, intuition and attention, get stuck in negative thought pattern, confusion
Imbalanced Sahasrar chakra		Poor coordination, difficulty in meditation and spiritual practices, unable to feel peaceful

Level 6

Ladders		Meaning
Vairagya		State of being free of attachment to materialistic life
Abhayas		Practice repeatedly to get perfection in a skill
Maitri		Loving-kindness, towards oneself as well as others
Karuna		One identifies the suffering of others as one's own.
Mudita		Empathetic joy as a result of knowing that others are happy.
Upeksha		A sense of even-mindedness.
Yukta ahara		Balanced diet
Satsang		Being in company with good people
Vivek		Ability to differentiate between real and unreal
Mauna		Practicing silence
Anushasan		Discipline

Snakes		Meaning
Moha		Attachment
Mada		Ego
Irshya		Intense dislike
Dormanasya		Frustration caused due to non-fulfillment of wishes
Ang-mejayatva		Shivering of body
Dukh		Misery
Vyadhi		Physical disease/ ailment
Styan		Lack of interest or motivation
Sanshya		Lack of faith
Pramad		Carelessness
Alasya		Love of comfort and mental ease/ laziness
Avirti		Stuck into desires

Level 7

Ladders		Meaning
Shukla-karma		Good deeds
Kshama		Forgiveness
Dhriti		Steadiness and strength in the mind
Daya		Compassion
Arjavam		Sincerity and harmony in one's thought
Mitahar		Moderate eating
Daan		Giving away as charity
Yajna		Sacrifice
Shravan		Careful listening
Vyavhar-kushalta		Good behavior
Kaivalya		Merge yourself with supreme consciousness

Snakes		Meaning
Krishna-karma		Bad deeds
Cruelty		State of being cruel
Adhi		Mental disorders
Tamas		Quality of dullness or inactivity, apathy, inertia or lethargy
Kama		Lust
Krodha		Anger
Lobh		Greed
Matsarya		Jealous

In the designed game "Yogapatnam", both types of yogic terms produce either positive or negative effects and their operational definitions have been given according to the yogic texts Patanjali's Yoga Sutras, Hathpradeepika, Shri Mad Bhagwad Geeta and Yog Vashishth.

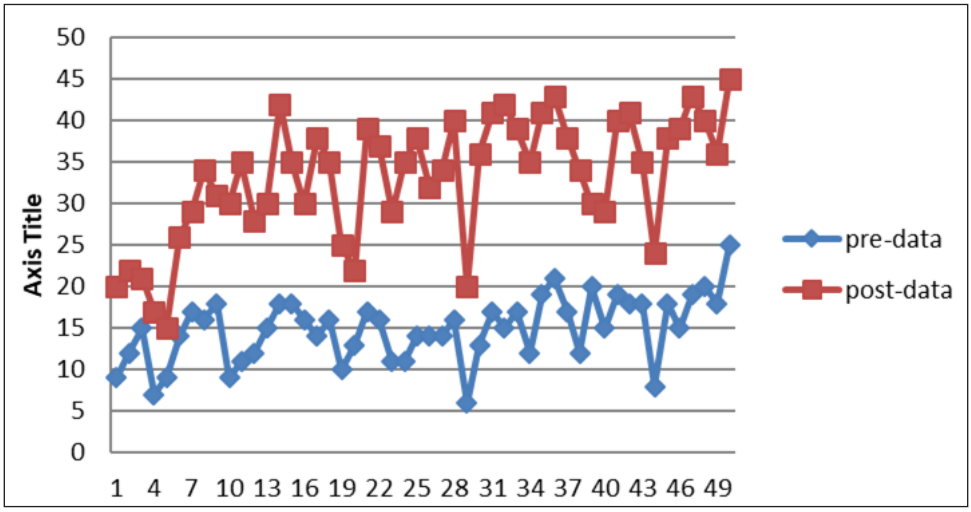
Implementation

A specially designed questionnaire (MCQ) related to yoga was asked of 6th- 8th-grade students of Navjyot Public School, Rohtak, Haryana, India, in which their knowledge about yoga was assessed. The questionnaire consists of 50 questions related to the basic terminology and meanings related to Yoga. Then, students were allowed to play 'Yogapatnam' for one month. As the purpose of our study was to include both practical and theoretical aspects of Yoga, we selected a school where Yoga has already been a part of the school curriculum. Hence, students were learning both practical and theoretical aspects of yoga. After the intervention, a post-test was conducted using the same questionnaire to assess the effect of mobile game applications on yoga education among students.

Data analysis

By using the paired 't' test, the data obtained in pre & post-tests was analysed with the help of SPSS version 26. The data collected from the sample is shown in the chart below. The blue line and brown line data indicate pre and post data, respectively.

Figure-7: Pre (Blue) and Post (Brown) Data



Results

Table-1: Descriptive Statistics

	N	Mean	Std. Deviation	Std. Error Mean
Pre Data	50	14.88	3.89	0.55
Post Data	50	33.16	7.45	1.05

Table-2: Paired sample correlation

	N	Correlation	Sig.
Pre data & Post data	50	.729	.000

Table-3: Paired sample t- test

Mean	Std. Deviation	Std. Error Mean	Lower	Upper	T	df	Sig.(two tailed)
-18.28	5.33	0.75	-19.79	-16.76	-24.25	49	<0.0001

Tables 1, 2 and 3 depict descriptive statistics, paired sample correltaion and paired t-test values. The intervention drawn from the Yogapatnam mobile game is found to be significant at $p < 0.0001$ for a sample size of 50 students. The calculated absolute value of the paired 't' statistic was found to be 24.25, which is compared with the table value, i.e. 3.496 at 49 degrees of freedom, which was significant at $p< 0.0005$ level of significance. As the calculated value of 't' was much greater than the table value, it can be argued that the t in the present study is very significant and can be used as an effective medium and as a teaching aid for children. The correlation between pre and post-data is 0.729, which indicates a significant positive relation.

Discussion

This study aims to prove the efficacy of the 'Yogapatnam' game application by introducing it to 50 school children and evaluating their level of yoga education before and after. There was a significant improvement in the yoga education ($p=0.000$) of the experimental group following 1 month of "Yogapatnam" game practice, as shown in Table 3. The mean of marks obtained at 0 days is 14.88, and after 30 days, it was 33.16, which shows the significant positive effect of the games on the level of yoga education. The intention behind E-Learning is not to replace conventional methods of teaching and learning in the classroom. It is aimed at creating an augmented learning environment where technology is used to deliver a combined range of teaching and learning techniques aimed at maximising individual participation (Anwar et al., 2020). Understand Yoga education takes one's lifetime, while in this application, we attempted to use a fraction of the Yogic knowledge to introduce children to some basic concepts of Yoga. As Yoga is a vast subject, many other valuable concepts may be included in further research.

Conclusion

Results indicate that the "Yogapatnam" game may be helpful in transmitting the yogic knowledge hidden in yogic scriptures given by ancient sages. It has simplified the basic concepts of yoga, so; the teachers may also use it as a yoga teaching tool. It is concluded that the 'Yogapatnam' game learning medium is acceptable, feasible and effective.

Declaration of interest: None

Declaration of generative AI in scientific writing: During the preparation of this work the authors used "Unity Engine" in order to develop the mobile game application. After using this tool/service, the authors reviewed and edited the content as needed and took full responsibility for the content of the publication.

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Research Article

Teachers' Competencies in Effective Technology-Enabled Assessment for Holistic Development of Students

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Abstract

The 21st century has witnessed a profound transformation in education with the integration of technology-enabled assessment. This study aims to identify the key competencies that teachers require for effective technology-enabled assessment for the holistic development of students at the secondary level of school education. A descriptive survey method was used for collecting data from 60 secondary school teachers in Suti, Murshidabad, West Bengal, through a self-constructed 5-point scale. The results highlight significant gaps in teachers' digital literacy, with a lack of formal training in educational software and applications and familiarity with learning management systems and online platforms for assessments. Teachers also face challenges in analyzing and interpreting assessment data, leading to difficulties in providing personalized feedback and adapting instructional methods. The study underscores the urgent need for teacher training and professional development programmes, specifically targeting digital literacy, data analysis, and the design of innovative assessments. Ethical considerations, including data privacy and the promotion of digital citizenship, are also identified as critical issues that require attention. By addressing these competencies, teachers can effectively implement the potential of technology-enabled assessments, foster vital skills in students and prepare them for success in the digital age. Ultimately, this study emphasizes the importance of empowering teachers to become agents of change through the development of their competencies, which can guide students towards becoming well-rounded and adaptable individuals in the ever-evolving digital world.

Keywords: Holistic Development, School Education, Secondary Level, Teachers' Competencies, Technology-Enabled Assessment

Introduction

The educational landscape of the 21st century has been profoundly reshaped by the integration of technology within teaching and learning practices. One of the most impactful advancements in this realm is technology-enabled assessment, which has emerged as a powerful tool that empowers educators to nurture the holistic development of students. In an era marked by rapid digital transformation, it is essential for teachers to develop the competencies required to effectively harness technology in the assessment process (Smith & Johnson, 2020).

Technology-enabled assessment provides educators with unparalleled opportunities to create personalized and engaging learning experiences. By leveraging interactive multimedia platforms, formative assessment tools, and sophisticated learning analytics, teachers can obtain real-time insights into students' progress and allow them to adapt their instruction to meet individual learning needs (Brown & Lee, 2021). This adaptability enhances the learning experience and fosters an environment where students can thrive academically and develop key skills. Beyond academic performance, the use

of technology in assessments supports the cultivation of critical life skills such as problem-solving, collaboration, critical thinking, and digital literacy (Garcia & Martinez, 2019). These competencies are crucial for students to succeed in an increasingly interconnected digital world. Furthermore, technology-enabled assessments empower students by encouraging self-directed learning and motivating them to take active ownership of their educational journeys. When teachers possess the skills needed to leverage these technological tools, they can act as agents of transformative change and guide students to become well-rounded, adaptable individuals prepared for future challenges.

Technology-enabled assessment is essential for the holistic development of students, as it goes beyond simply measuring academic performance and plays a critical role in nurturing social, emotional, and cognitive growth. Traditional assessment methods often focus solely on academic achievement, but technology-enhanced assessment methods allow for a more comprehensive approach, offering insights into a student's overall development. One of the primary advantages of technology-enhanced assessment is its ability to provide real-time feedback, which enables teachers to make timely instructional adjustments that meet the unique needs of each learner. By leveraging data-driven insights, educators can identify areas of improvement and celebrate achievements, thus fostering a continuous learning cycle that benefits students. Additionally, technology in assessments supports differentiated learning paths, allowing for personalized instruction that caters to the diverse learning needs of students. This adaptability ensures that each student is appropriately challenged, whether they need additional support or further enrichment. As a result, technology helps create a more inclusive learning environment where every student, regardless of ability, has access to the resources and opportunities necessary for success. Another significant advantage of technology-enabled assessment is its role in promoting self-regulation and critical reflection—skills vital for lifelong learning. With access to immediate feedback, students can actively engage with their learning process, identify their strengths and weaknesses, and make adjustments to their approach. This self-awareness helps students become more independent and motivated learners, taking ownership of their educational journey. Moreover, technology-integrated assessment fosters the development of emotional intelligence and social skills. Through collaborative and project-based learning tools, students are encouraged to work together, solve complex problems, and communicate effectively. These experiences not only enhance their academic understanding but also teach valuable interpersonal skills, such as teamwork, empathy, and conflict resolution. These competencies are essential for students as they navigate real-world challenges in a rapidly changing and interconnected society. Ultimately, technology-enabled assessment serves as a powerful mechanism for developing well-rounded individuals who can navigate the complexities of the modern world (Albinson, Cetinkaya, & Orman, 2020). However, Effective implementation of technology-enabled assessment comes with its own set of challenges. Educators must address ethical considerations, including data privacy and security, and work to bridge the digital divide to ensure equitable access for all students (UNESCO, 2022). It is, therefore, essential for teacher training and professional development programmes to prioritize building digital competency, foster an understanding of ethical practices,

and empower teachers to navigate the complexities of digital tools and data responsibly.

This article highlights the significance of teachers' competencies in effective technology-enabled assessment for the holistic development of students. By embracing technology, teachers have the potential to revolutionize the educational experience, cater to diverse learner needs and foster essential skills for the future. As we continue to embrace the digital revolution in education, empowering teachers with the necessary competencies will be instrumental in maximizing the potential of technology-enabled assessment to shape the next generation of lifelong learners.

Objective of the Study

1. To identify the key competencies that teachers require for effective technology-enabled assessment for the holistic development of students at the secondary level of school education.

Research Question of the Study

1. What specific competencies do secondary school teachers believe are critical for implementing technology-enabled assessment effectively?

Operational Definitions of the Key Concepts:

Competencies of Teachers: In the study, teachers' competencies refer to their proficiency in utilizing digital tools and technologies to enhance assessment practices. The present study focused on the following five competencies of teachers for technology-enabled assessment: 'Competencies of Teachers in Digital Literacy and Technology Skills', 'Competencies of Teachers in Data Analysis and Interpretation', 'Competencies of Teachers in Personalization and Differentiation', 'Competencies of Teachers in Pedagogical Practices and Innovative Assessment Design', 'Competencies of Teachers in Ethical Use of Technology in Assessment'.

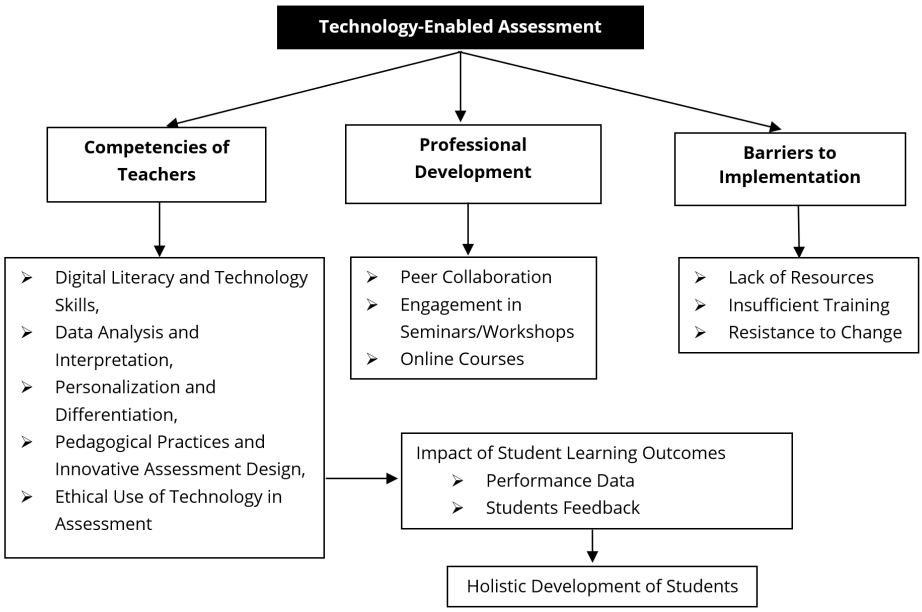
Technology-Enabled Assessment: It refers to the integration of digital tools and platforms in the assessment process to evaluate and enhance students' learning. This approach encompasses a variety of methods, including online quizzes, interactive assessments, and digital portfolios that facilitate real-time feedback and data collection. This approach not only streamlines the assessment process but also fosters engagement and collaboration among students and supports their holistic development by promoting critical thinking, problem-solving skills, and digital literacy. The present study focused on technology-enabled assessment competencies of teachers at a secondary level of school education.

Holistic Development of Students: It refers to the comprehensive growth and maturation of learners across multiple dimensions, including cognitive, emotional, social, physical, and ethical aspects. This approach emphasizes the importance of nurturing the whole child rather than focusing solely on academic achievement. Holistic development promotes a balanced education that integrates various learning experiences, including collaborative projects, creative activities, and community engagement, allowing students to connect knowledge to real-world applications. By prioritizing holistic development, teachers aim to cultivate well-rounded individuals who are prepared to thrive in diverse environments and contribute positively to society. The present study highlighted on holistic development of secondary school students based on technology-enabled assessment.

Conceptual Framework

The conceptual framework presented here outlines the role of technology-enabled assessment in advancing educational outcomes through a structured, multi-dimensional approach. At the centre of this framework is the focus on 'Technology-Enabled Assessment', which acts as a bridge between teacher competencies, professional development, and the barriers associated with implementing technology in assessment. Each element in the framework supports the holistic development of students. Teacher competencies in 'Digital Literacy and Technology Skills', 'Data Analysis and Interpretation', 'Personalization and Differentiation', 'Pedagogical Practices and Innovative Assessment Design', and 'Ethical Use of Technology in Assessment' are essential for creating effective learning environments. Professional development opportunities such as workshops, online courses, and peer collaboration equip educators with the necessary skills to adopt and integrate technology meaningfully. However, successful implementation often faces barriers, including a lack of resources, insufficient training, and resistance to change within educational institutions. Together, these components contribute to enhanced student learning outcomes, as technology-enabled assessment provides performance data and enables gathering of student feedback. This framework, therefore, emphasizes a collaborative approach to leveraging technology in assessment to drive holistic development and improve learning outcomes.

Figure-1: Conceptual Framework



Review of Related Literature

The integration of technology in assessment practices has increasingly gained attention as educators and researchers recognize its potential to enhance student learning and support holistic development. Technology-enabled assessment not only facilitates real-time data collection but also

enables personalized feedback, aligning with the evolving educational needs of the 21st century (Hartnett, Brown, & Anderson, 2014). This shift towards technology is increasingly being seen as a way to promote more interactive and learner-centered approaches that emphasize the development of a broad range of student skills, including cognitive, social, emotional, and digital competencies (Gulikers, Bastiaens, & Kirschner, 2004).

Research emphasizes the need for teachers to develop digital competencies to navigate technology-enabled assessments effectively. Shute and Rahimi (2017) provide an overview of how formative assessments can be enhanced through digital tools, discussing platforms that support personalized feedback and adaptive learning paths. Their findings suggest that formative digital assessments help in identifying individual student needs, making real-time intervention possible, which is essential for promoting holistic development. Ertmer and Ottenbreit-Leftwich (2010) highlight that digital literacy and proficiency with educational tools are crucial for teachers to create engaging and adaptive assessments. Teachers' competencies in using technology for formative assessment tools and learning management systems can lead to enhanced student outcomes (Pawar & Yoon, 2021). However, studies indicate a general lack of training in these areas, as educators often lack the skills to analyze and interpret data, hindering personalized feedback and intervention (Fletcher, Iannucci & Scanlon, 2024). A study by Cifuentes, Maxwell, and Bulu (2011) points to the gap in teacher training programmes related to digital assessment tools. Their findings reveal that teachers often feel unprepared to integrate technology-based assessment methods due to limited exposure and training. Innovative assessment design facilitated by technology allows teachers to move beyond traditional testing methods. According to Wiliam (2006), incorporating interactive and gamified assessments fosters critical thinking, problem-solving, and student engagement. These methods, when supported by technology, encourage students to actively participate in their learning journeys, which is essential for holistic development (Looney, 2019). Furthermore, technology-enabled assessment supports collaborative learning through peer reviews and group projects, enhancing skills necessary for success in the digital age. Collaborative assessments, when designed properly, offer opportunities for students to engage in meaningful interactions with peers, providing constructive feedback and developing skills in teamwork, communication, and conflict resolution. This collaborative aspect is particularly beneficial in developing social and emotional intelligence (Youngren, 2021). Despite its benefits, technology-enabled assessment presents challenges, including ethical considerations around data privacy and digital equity. UNESCO (2024) stresses the importance of teachers' awareness in navigating data privacy and promoting responsible digital citizenship among students. In regions with limited access to digital resources, a digital divide persists, creating inequalities in assessment experiences (Anderson & Kumar, 2019). Teachers must be equipped not only with technical skills but also with the ethical frameworks necessary to safeguard student data and ensure that all students have equal access to digital learning resources. Teachers' competencies in handling these ethical and logistical challenges are critical to ensuring that technology-enhanced assessment methods benefit all students equitably (Yadav, 2024). Professional development programmes are essential to bridging gaps in teachers' digital skills and enhancing their competencies in using educational

software and platforms. Darling-Hammond et al. (2017) suggest that continuous training enables teachers to adapt their instructional methods to accommodate technology-enabled assessment, ultimately supporting student growth. Effective teacher training should prioritize data analysis, personalized feedback strategies, and digital literacy, equipping teachers to manage and utilize technology-enhanced tools in a meaningful way (Guskey & Yoon, 2009). Selwyn (2016) examines the ethical dimensions of technology in education, emphasizing issues of student data privacy, consent, and the implications of data tracking. This study encourages schools to adopt clear policies and educate both students and teachers on responsible data practices to safeguard privacy.

The literature suggests that while technology-enabled assessment holds significant potential for holistic development of students, the effectiveness of these assessments hinges on teachers' digital competencies, innovative assessment strategies, and a strong understanding of ethical considerations. Addressing these competencies through targeted professional development can empower teachers to harness technology in ways that foster student success in a rapidly evolving digital world.

Significance of the Study

The significance of the study lies in its comprehensive exploration of five crucial categories that play a pivotal role in leveraging technology for the holistic development of students.

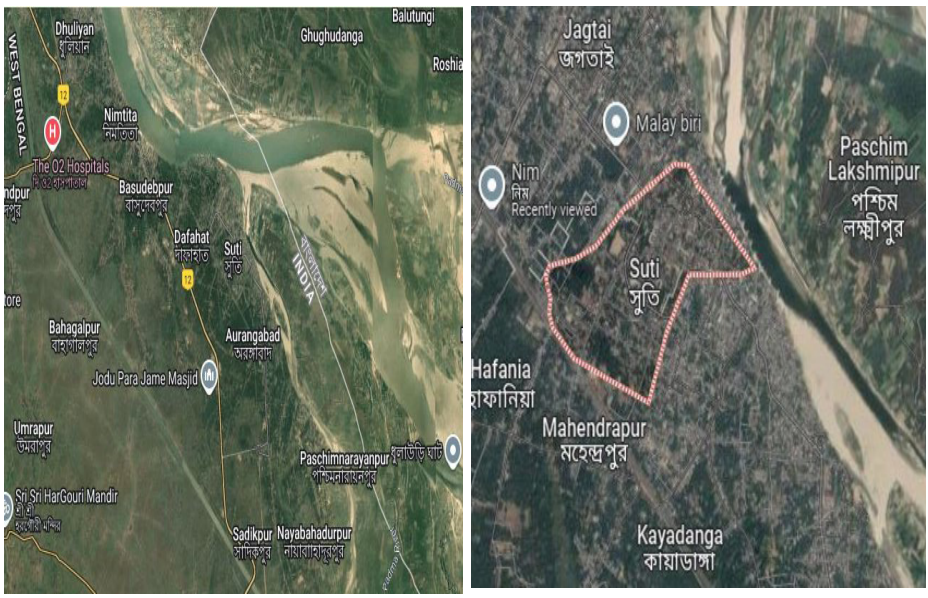
The study recognizes the importance of equipping teachers with digital literacy and technology skills. As technology becomes an integral part of education, teachers must possess the knowledge and confidence to navigate digital tools, platforms, and resources effectively. Understanding how to use technology for instructional purposes empowers educators to create engaging and interactive learning experiences, enhancing student motivation and fostering a deeper understanding of concepts. Technology-enabled assessment generates a wealth of data that can inform instructional decisions. This study emphasizes the significance of teachers' competencies in analyzing and interpreting data derived from various assessment tools and platforms. By interpreting data insights, teachers can identify students' strengths and areas for improvement, providing personalized feedback and targeted interventions to cater to individual learning needs. Technology allows for personalized and differentiated learning experiences. The study highlights the importance of teachers' competencies in tailoring instruction to meet the unique needs and preferences of each student. By leveraging technology, teachers can adapt content, pace, and assessments to align with individual learning styles, fostering a more inclusive and effective learning environment. Effective technology-enabled assessment goes beyond traditional methods. This study emphasizes the significance of teachers' competencies in employing innovative assessment designs that align with pedagogical practices. By integrating technology into assessment, educators can move beyond conventional approaches, embracing formative assessments, interactive quizzes, and multimedia projects that facilitate active learning and deeper engagement. As technology integration in education expands, ethical considerations become critical. The study underscores the importance of teachers' competencies in adhering to ethical principles when using technology for assessment. Respecting student privacy and data security and promoting equitable access to technology are essential aspects that teachers must prioritize while employing technology-enabled assessment methods.

The significance of this study lies in its comprehensive focus on five key points that shape the successful implementation of technology-enabled assessment for the holistic development of students. By addressing digital literacy, data analysis, personalization, innovative assessment design, and ethical considerations, the research provides valuable insights and recommendations for educators, policymakers, and stakeholders. Embracing these competencies empowers teachers to leverage technology as a powerful tool for enhancing student learning experiences, fostering comprehensive growth, and preparing the next generation of learners for the challenges of the digital age.

Context of the Educational Setting

Suti, located in the Murshidabad district of West Bengal, is a rural area where 'Beedi Industry' plays a dominant role in the economy. Here, secondary education faces challenges such as limited access to digital infrastructure, including internet connectivity and modern devices. Teachers often lack formal training in educational technology, hindering their ability to implement technology-enabled assessments effectively. Despite these obstacles, government initiatives like Digital India are gradually improving access to technology in the region. However, the rural setting also presents opportunities for collaborative learning, where teachers and students can support each other in overcoming technological challenges. With targeted professional development, teachers in Suti can enhance their digital competencies and effectively use technology to foster holistic student development. Addressing these challenges will be crucial in preparing students for success in the digital era.

Figure-2: Location Map of Study Area



Source: http://www.maplandia.com/india/west-bengal/murshidabad/suti/ & Google Image

Methodology

Research Method: The present study was followed by the descriptive survey method. Investigator had collected data through a 5-Point Scale (by using Google Form) from teachers at secondary level of school education.

Population and Sample: The investigation was carried out among 60 teachers of secondary level of school education at Suti, Murshidabad, West Bengal. The study's sample was selected using the convenience sampling method. The study's target population was teachers of secondary level of school education residing in the Murshidabad district of West Bengal.

Tool: The researcher utilized a self-constructed 5-point scale to measure the competencies of teachers in effective technology-enabled assessment for the holistic development of students at the secondary level of school education. The investigator utilized an internal reliability test to evaluate the reliability of the research tool. The reliability of the self-constructed tool was 0.82 (Cronbach's Alpha). The content validity of the self-constructed 5-point scale was assessed by the researcher by taking experts' views.

Analysis and Interpretation

The objective of the study was to identify the key competencies that teachers require for effective technology-enabled assessment for the holistic development of students at the secondary level of school education. The study explores five crucial categories that are required among teachers for effective technology-enabled assessment for the holistic development of students. Responses of teachers were scored on spread sheet (Excel) and tabulated. Frequency and percentage were calculated with the help of spread sheet (Excel) software and presented in the following tables.

Table-1: Competencies of Teachers in Digital Literacy and Technology Skills

Proficiency in using digital devices (e.g., computers, tablets, smart phones) for educational purposes.	**Very proficient**	**Proficient**	**Moderately proficient**	**Somewhat proficient**	**Not proficient**
	01 (1.67%)	02 (3.33%)	03 (5.00%)	04 (6.67%)	50 (83.33%)
Received formal training in utilizing educational software and applications for instructional activities and assessments.	Yes, extensively	Yes, to some extent	No, but I have some experience	No, I have not received any training	Not applicable
	00 (0.00%)	00 (0.00%)	02 (3.33%)	58 (96.67%)	00 (0.00%)

Familiarity with learning management systems (LMS) and online platforms for managing and delivering assessments.	Highly familiar	Familiar	Moderately familiar	Somewhat familiar	Not familiar
	00 (0.00%)	00 (0.00%)	00 (0.00%)	00 (0.00%)	60 (100%)
Comfortable in troubleshooting basic technical issues that may arise during technology-enabled assessments	Very comfortable	Comfortable	Neutral	Somewhat uncomfortable	Very uncomfortable
	01 (1.67%)	02 (3.33%)	02 (3.33%)	07 (11.67%)	48 (80.00%)

Table 1 indicates that 83.33 per cent of teachers have not any proficiency in using digital devices (e.g., computers, tablets, smartphones) for educational purposes. 96.67 per cent of teachers have not received any formal training in utilizing educational software and applications for instructional activities and assessments. 100 per cent of teachers are not familiar with learning management systems (LMS) and online platforms for managing and delivering assessments. 80 per cent of teachers feel very uncomfortable in troubleshooting basic technical issues that may arise during technology-enabled assessments.

Table-2: Competencies of Teachers in Data Analysis and Interpretation

Confidence in analyzing assessment data to identify students' strengths and areas for improvement	**Very confident**	**Confident**	**Moderately confident**	**Somewhat confident**	**Not confident**
	02 (3.33%)	02 (3.33%)	04 (6.67%)	07 (11.67%)	45 (75.00%)
Used assessment analytics software to interpret data and make data-driven instructional decisions	Yes, frequently	Yes, occasionally	No, but have some experience	No, have not used any analytics software	Not applicable
	00 (0.00%)	00 (0.00%)	01 (1.67%)	59 (98.33%)	00 (0.00%)
Ability to identify patterns and trends in assessment results to inform your teaching practices and curriculum planning	Highly skilled	Skilled	Moderately confident	Somewhat skilled	Not skilled
	02 (3.33%)	03 (5.00%)	05 (8.33%)	08 (13.37%)	42 (70.00%)

Utilized assessment data to adjust teaching methods and strategies for better student outcomes	Always	Often	Sometimes	Rarely	Never
	02 (3.33%)	04 (6.67%)	05 (8.33%)	04 (6.67%)	45 (75.00%)

Table 2 reveals that 75 per cent of teachers are not confident in analyzing assessment data to identify student's strengths and areas for improvement. 98.33 per cent of teachers have not used any analytics software to interpret data and make data-driven instructional decisions. 70 per cent of teachers are not skilled in identifying patterns and trends in assessment results to inform their teaching practices and curriculum planning. 75 per cent of teachers never utilized assessment data to adjust teaching methods and strategies for better student outcomes.

Table-3: Competencies of Teachers in Personalization and Differentiation

Used assessments to cater to diverse learning styles and individual student needs	**Always**	**Often**	**Sometimes**	**Rarely**	**Never**
	25 (41.67%)	12 (20.00%)	05 (8.33%)	08 (13.33%)	10 (16.67%)
Incorporated adaptive learning tools and platforms to personalize assessments and provide targeted feedback	Yes, regularly	Yes, occasionally	No, but willing to try	No, have not used adaptive tools	Not applicable
	00 (0.00%)	00 (0.00%)	02 (3.33%)	58 (96.67%)	00 (0.00%)
Ability to use strategies that accommodate students with varying abilities and learning preferences during technology-enabled assessments	Highly effective	Effective	Moderately effective	Somewhat effective	Ineffective
	02 (3.33%)	02 (3.33%)	08 (13.33%)	08 (13.33%)	40 (66.68%)
Addressed individual student needs while designing technology-enabled assessments	Very well	Well	Adequately	Not very well	Poorly
	02 (3.33%)	02 (3.33%)	01 (1.67%)	22 (36.67%)	33 (55.00%)

Table 3 highlights that 41.67 per cent of teachers always used assessments to cater to diverse learning styles and individual student needs. 96.67 per cent of teachers have never used adaptive learning tools and platforms to personalize assessments and provide targeted feedback. 66.68 per cent of teachers do not have any ability to use strategies that accommodate students with varying abilities and learning preferences during technology-enabled assessments. 55 per cent of teachers poorly addressed individual student needs while designing technology-enabled assessments.

Table-4: Competencies of Teachers in Pedagogical Practices and Innovative Assessment Design

Design technology-enabled assessments that promote critical thinking, problem-solving, and creativity among students	**Very well**	**Well**	**Adequately**	**Not very well**	**Poorly**
	02 (3.33%)	02 (3.33%)	04 (6.67%)	19 (31.67%)	33 (55.00%)
Familiar with innovative assessment methods, such as gamified assessments and project-based evaluations, and how to integrate them into teaching	Highly familiar	Familiar	Moderately familiar	Somewhat familiar	Not familiar
	00 (0.00%)	00 (0.00%)	02 (3.33%)	01 (1.67%)	57 (95.00%)
Used technology to create assessments that encourage collaborative learning and peer assessment	Always	Often	Sometimes	Rarely	Never
	01 (1.67%)	02 (3.33%)	05 (8.33%)	02 (3.33%)	50 (83.34%)
Ability to design technology-enabled assessments that engage students and foster a positive learning experience	Highly skilled	Skilled	Moderately confident	Somewhat skilled	Not skilled
	00 (0.00%)	00 (0.00%)	01 (1.67%)	02 (3.33%)	57 (95.00%)

Table 4 describes that 55 per cent of teachers poorly designed technology-enabled assessments that promote critical thinking, problem-solving, and creativity among students. 95 per cent of teachers are not familiar with innovative assessment methods, such as gamified assessments and project-based evaluations, and how to integrate them into teaching. 83.34 per cent of teachers never used technology to create assessments that encourage collaborative learning and peer assessment. 95 per cent of teachers are not skilled in designing technology-enabled assessments that engage students and foster a positive learning experience.

Table-5: Competencies of Teachers in Ethical Use of Technology in Assessment

Ensure the security and integrity of technology-enabled assessments to prevent cheating or academic dishonesty	**Strongly agree**	**Agree**	**Neutral**	**Disagree**	**Strongly disagree**
	00 (0.00%)	00 (0.00%)	04 (6.67%)	05 (8.33%)	51 (85.00%)
Aware of the ethical considerations related to collecting and using student data during technology-enabled assessments	Yes, well-informed	Yes, to some extent	No, but have some under-standing	Not aware of the ethical considera-tions	Not applicable
	00 (0.00%)	00 (0.00%)	10 (16.67%)	42 (70.00%)	08 (13.33%)
Promote digital citizenship and responsible technology use among students when conducting assessments online	Always	Often	Sometimes	Rarely	Never
	02 (3.33%)	01 (1.67%)	07 (11.67%)	05 (8.33%)	45 (75.00%)
ability to address ethical dilemmas that may arise during technology-enabled assessments in an appropriate and responsible manner	Highly capable	Capable	Moderately capable	Somewhat capable	Not capable
	00 (0.00%)	00 (0.00%)	00 (0.00%)	02 (3.33%)	58 (96.67%)

Table 5 indicates that 85 per cent of teachers are unable to ensure the security and integrity of technology-enabled assessments to prevent cheating or academic dishonesty. 70 per cent of teachers are not aware of the ethical considerations related to collecting and using student data during technology-enabled assessments. 75 per cent of teachers never promote digital citizenship and responsible technology use among students when conducting assessments online. 96.67 per cent of teachers believed that they are not capable of addressing ethical dilemmas that may arise during technology-enabled assessments in an appropriate and responsible manner.

In the present study investigator had used factor analysis statistical method to summarize and interpret the data scientific and systematic way. This strategy helped researcher to explain interrelationships among variables in terms of their common underlying dimensions i.e. factors. Investigator had used SPSS and AMOS statistical software to analyze the data.

Table-6: KMO and Bartlett's Test

KMO Measure of Sampling Adequacy		0.619
Bartlett's Test of Sphericity	Approx. Chi-Square	1265.134
	df	190
	Sig.	0.000

The Kaiser-Meyer-Olkin (KMO) is a statistical measure used to calculate the sampling sufficiency which needs to be more significant than 0.05 level for an appropriate study to proceed. Factor analysis can be inappropriate if the sample size of the study is below 50. The present study has a 60 sample size and 0.619 sampling ampleness (Mentioned in Table 6), which is enough for factor analysis. Bartlett's test is used to assess the consistency of the relationship among factors. Table 6 highlights that Bartlett's Test of Sphericity is significant at 0.01 level.

Figure-3: Factor Analysis Result (Standardized)

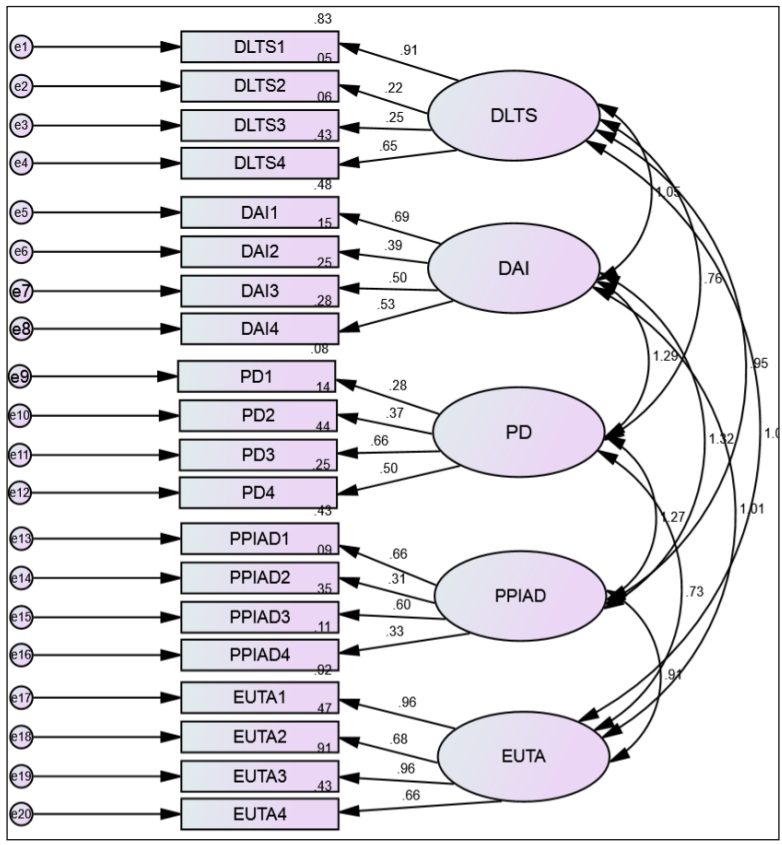


Table-7: Factor Analysis Result (Standardized) to Identify the Latent Variables

Code	Variables	Factor Loadings
Digital Literacy and Technology Skills (DLTS)		
DLTS1	Proficiency in Using Digital Devices	0.91
DLTS2	Formal Training	0.22
DLTS3	Familiarity with LMS	0.25
DLTS4	Comfortable in Troubleshooting Basic Technical Issues	0.65
Data Analysis and Interpretation (DAI)		
DAI1	Confidence in analyzing assessment data	0.69
DAI2	Used assessment analytics software	0.39
DAI3	Ability to identify patterns and trends in assessment	0.50
DAI4	Utilized assessment data to adjust teaching methods and strategies	0.53
Personalization and Differentiation (PD)		
PD1	Used assessments to cater to diverse learning styles	0.28
PD2	Incorporated adaptive learning tools and platforms	0.37
PD3	Ability to use strategies	0.66
PD4	Addressed individual student needs	0.50
Pedagogical Practices and Innovative Assessment Design (PPIAD)		
PPIAD1	Design technology-enabled assessments to promote critical thinking, problem-solving, and creativity	0.66
PPIAD2	Familiar with innovative assessment methods	0.31
PPIAD3	Used technology to create assessments	0.60
PPIAD4	Design technology-enabled assessments to engage students and foster positive learning experience	0.33
Ethical Use of Technology in Assessment (EUTA)		
EUTA1	Security and integrity of technology-enabled assessments	0.96
EUTA2	Awareness of the ethical considerations related to collecting and using student data	0.68
EUTA3	Promote digital citizenship and responsible technology use	0.96
EUTA4	ability to address ethical dilemmas	0.66

The present study has analyzed data through the confirmatory factor analysis method. The study has found a total of 45 variables (20 observed

variables and 25 unobserved variables). The study is recursive in nature, which means no variable in the study has any effect on itself. The result of the study indicates that it has five major variables such as 'Digital Literacy and Technology Skills' (DLTS), 'Data Analysis and Interpretation' (DAI), 'Personalization and Differentiation' (PD), 'Pedagogical Practices and Innovative Assessment Design'(PPIAD), Ethical Use of Technology in Assessment' (EUTA). The majority of the observed variables (DLTS1, DLTS4, DAI1, DAI4, PD3, PPIAD1, PPIAD3, EUTA1, EUTA2, EUTA3, and EUTA4) have high factor loading values (more than 0.5). A few observed variables, such as DAI3 and PD4, have equal 0.50 factor loading values. Some observed variables like DLTS2, DLTS3, DAI2, PD1, PD2, PPIAD2, and PPIAD4 have less than 0.50-factor loadings values. This means these observed variables are also influential factors for the development of teachers' competencies in effective technology-enabled assessment for the holistic development of students.

Table-8: Factor Analysis Result (Standardized) to Identify the Correlations

Variables			Estimate
DLTS	<-->	DAI	1.053
DAI	<-->	PD	1.291
PD	<-->	PPIAD	1.266
PPIAD	<-->	EUTA	.915
DLTS	<-->	EUTA	1.076
DLTS	<-->	PD	.755
DLTS	<-->	PPIAD	.945
DAI	<-->	PPIAD	1.321
DAI	<-->	EUTA	1.009
PD	<-->	EUTA	.732

Table 8 points out that five major variables, such as 'Digital Literacy and Technology Skills', 'Data Analysis and Interpretation', 'Personalization and Differentiation', 'Pedagogical Practices and Innovative Assessment Design', and Ethical Use of Technology in Assessment' are highly correlated (above 0.70) among each other. It means all major variables are influential factors for the development of teachers' competencies in effective technology-enabled assessment for the holistic development of students.

Findings of the Study

- The study has found a total of 45 variables (20 observed variables and 25 unobserved variables). The result of the study indicates that it has five major variables such as 'Digital Literacy and Technology Skills', 'Data Analysis and Interpretation', 'Personalization and Differentiation', 'Pedagogical Practices and Innovative Assessment Design', and Ethical Use of Technology in Assessment'. The majority of the observed variables (DLTS1, DLTS4, DAI1, DAI4, PD3,

PPIAD1, PPIAD3, EUTA1, EUTA2, EUTA3, and EUTA4) have high factor loading values (more than 0.5). Few observed variables like DAI3 and PD4 have equal 0.50 factor loadings values. Some observed variables like DLTS2, DLTS3, DAI2, PD1, PD2, PPIAD2, and PPIAD4 have less than 0.50-factor loadings values.

- The results of the study indicated that five major variables such as 'Digital Literacy and Technology Skills', 'Data Analysis and Interpretation', 'Personalization and Differentiation', 'Pedagogical Practices and Innovative Assessment Design', Ethical Use of Technology in Assessment' are highly correlated (above 0.70) among each other.
- 83.33 per cent of teachers have not any proficiency in using digital devices (e.g., computers, tablets, smart phones) for educational purposes.
- 96.67 per cent of teachers have not received any formal training in utilizing educational software and applications for instructional activities and assessments.
- 100 per cent of teachers are not familiar with learning management systems (LMS) and online platforms for managing and delivering assessments.
- 80 per cent of teachers feel very uncomfortable in troubleshooting basic technical issues that may arise during technology-enabled assessments.
- 75 per cent of teachers are not confident in analyzing assessment data to identify student's strengths and areas for improvement.
- 98.33 per cent of teachers have not used any analytics software to interpret data and make data-driven instructional decisions.
- 70 per cent of teachers are not skilled in identifying patterns and trends in assessment results to inform their teaching practices and curriculum planning.
- 75 per cent of teachers never utilized assessment data to adjust teaching methods and strategies for better student outcomes.
- 41.67 per cent of teachers always used assessments to cater to diverse learning styles and individual student needs.
- 96.67 per cent of teachers have never used adaptive learning tools and platforms to personalize assessments and provide targeted feedback.
- 66.68 per cent of teachers do not have any ability to use strategies that accommodate students with varying abilities and learning preferences during technology-enabled assessments.
- 55 per cent of teachers poorly addressed individual student needs while designing technology-enabled assessments.
- 55 per cent of teachers poorly designed technology-enabled assessments that promote critical thinking, problem-solving, and creativity among students.
- 95 per cent of teachers are not familiar with innovative assessment methods, such as gamified assessments and project-based evaluations, and how to integrate them into teaching.
- 83.34 per cent of teachers never used technology to create assessments that encourage collaborative learning and peer assessment.
- 95 per cent of teachers are not skilled in designing technology-enabled assessments that engage students and foster a positive learning experience.

- 85 per cent of teachers are unable to ensure the security and integrity of technology-enabled assessments to prevent cheating or academic dishonesty.
- 70 per cent of teachers are not aware of the ethical considerations related to collecting and using student data during technology-enabled assessments.
- 75 per cent of teachers never promote digital citizenship and responsible technology use among students when conducting assessments online.
- 96.67 per cent of teachers believed that they are not capable of addressing ethical dilemmas that may arise during technology-enabled assessments in an appropriate and responsible manner.

Discussion

The present study delves into the essential competencies that teachers need to effectively employ technology-enabled assessment for the holistic development of secondary-level students. The study's findings underscore several critical gaps in teachers' competencies like digital literacy, data analysis skills, and their ability to design innovative, personalized assessments - issues and shed light on the urgent need for comprehensive training and professional development programmes to address these shortcomings.

Comparing the findings of this study with previous research, it becomes evident that the challenges identified in this study are not isolated occurrences but are consistent with the broader landscape of technology integration in education. The literature review highlighted the growing importance of digital competencies in education, with Shute and Rahimi (2017) noting the essential role of technology in formative assessments, particularly through personalized feedback and adaptive learning tools. However, the current study found that 96.67 per cent of teachers had not received formal training in educational software and applications, and 100 per cent were unfamiliar with learning management systems (LMS) and online platforms for assessments. This finding mirrors the work of Cifuentes, Maxwell, and Bulu (2011), who found a gap in teacher preparation programmes for digital assessment tools, leading to a lack of confidence in utilizing technology for assessment purposes. This gap in digital literacy, as identified in the study, is an essential barrier to the effective integration of technology-enabled assessments. The review of literature also depicted the importance of teachers' ability to analyze and interpret assessment data to offer personalized feedback, a key competency identified by Ertmer and Ottenbreit-Leftwich (2010) and Pawar & Yoon (2021). In the present study, 75 per cent of teachers were not confident in analyzing assessment data, and 98.33 per cent had never used analytics software to interpret data. This significant deficiency in data interpretation abilities is concerning, as it limits the potential of technology-enabled assessments to support personalized learning and intervention. The literature suggests that addressing this gap through professional development could improve teachers' capacity to use data effectively, enhancing student outcomes, as discussed by Shute and Rahimi (2017). Innovative assessment designs, such as gamified assessments, project-based evaluations, and collaborative learning, were emphasized in the literature as essential for fostering critical thinking and student engagement (Wiliam, 2006; Looney, 2019). However, the present study's findings revealed that 95 per cent of teachers were not familiar

with innovative assessment methods, and 83.34 per cent had never used technology to create assessments that encourage collaborative learning. This gap aligns with the concerns expressed by Garcia and Martinez (2019), who noted the need for teachers to be trained in innovative assessment strategies that foster critical thinking and collaboration. The lack of familiarity with these methods underscores the need for professional development programmes that focus on innovative, technology-driven assessment strategies. The review of literature also discussed the ethical dimensions of technology in education, particularly concerning data privacy and digital citizenship, as highlighted by UNESCO (2024). The current study corroborates these concerns, revealing that 70 per cent of teachers were not aware of ethical considerations related to collecting and using student data during technology-enabled assessments. Moreover, 75 per cent of teachers reported not promoting digital citizenship and responsible technology use among students. These findings echo the call from UNESCO (2024) and Yadav (2024) for a deeper focus on ethical issues in teacher training, particularly in the context of technology integration. Teachers must be equipped not only with technical skills but also with an understanding of ethical and responsible technology use to ensure equitable and secure assessments.

Overall, the present study's findings are consistent with the broader discourse in the literature, which stresses the need for comprehensive teacher training in digital literacy, data analysis, innovative assessment strategies, and ethical considerations. By addressing these competencies through targeted professional development, teachers can become more effective in leveraging technology to enhance student learning and support holistic development. This study aligns with the recommendations of Darling-Hammond et al. (2017) and Guskey & Yoon (2009), who emphasized the importance of continuous training in enabling teachers to adapt their instructional practices to accommodate the demands of technology-enabled assessments.

Educational Implications

The findings of the study reveal critical insights into the competencies of teachers in utilizing technology-enabled assessment for the holistic development of students. These findings have significant educational implications:

1. **Teacher Training and Professional Development:** The study highlights the urgent need for comprehensive teacher training and professional development programmes focusing on digital literacy and technology integration. Teachers must be equipped with the necessary skills to use digital devices, educational software, learning management systems, and online platforms effectively.
2. **Data Analysis and Interpretation:** Teachers need support in data analysis and interpretation to make informed instructional decisions. Professional development should focus on using analytics software to interpret assessment data and identify students' strengths and areas for improvement, leading to personalized feedback and targeted interventions.
3. **Personalized Learning and Differentiation:** To foster an inclusive learning environment, teachers should receive training in designing technology-enabled assessments that cater to diverse learning styles and individual student needs. Utilizing adaptive learning tools and platforms can help personalize assessments and provide targeted feedback.

4. **Innovative Assessment Design:** Teacher training programmes should emphasize innovative assessment methods, such as gamified assessments and project-based evaluations, and how to integrate them into teaching. These assessments can promote critical thinking, problem-solving, and creativity among students.
5. **Ethical Considerations and Digital Citizenship:** Teachers must be aware of ethical considerations related to data privacy, security, and responsible technology use during technology-enabled assessments. Promoting digital citizenship among students will help create a responsible and ethical online learning environment.
6. **Collaborative Learning and Peer Assessment:** Teachers should be encouraged to use technology to design assessments that foster collaborative learning and peer assessment. This can enhance student engagement and provide valuable learning experiences.
7. **Addressing Ethical Dilemmas:** Teachers need support and guidance in addressing ethical dilemmas that may arise during technology-enabled assessments. Professional development programmes can help teachers develop strategies for handling such situations appropriately and responsibly.
8. **Promoting Positive Learning Experiences:** Teachers should be empowered to use technology to create assessments that engage students and foster positive learning experiences. Engaging and interactive assessments can enhance student motivation and learning outcomes.
9. **Equity and Access:** Policymakers and educational institutions should work towards bridging the digital divide to ensure equitable access to technology-enabled assessment tools for all students. Providing access to technology for both teachers and students is crucial for successful implementation.
10. **Curriculum Integration:** The study underscores the need to integrate technology-enabled assessment seamlessly into the curriculum. Teachers should receive support in aligning assessment practices with pedagogical goals, promoting effective teaching and learning.

The study's educational implications emphasize the importance of empowering teachers with the necessary competencies to leverage technology-enabled assessment effectively. By addressing these implications through teacher training and professional development initiatives, educational institutions can create an environment that fosters holistic student development, prepares learners for the future, and maximizes the potential of technology in education.

Limitations of the Study

While this study provides valuable insights into the competencies required for effective technology-enabled assessment, there are several limitations to consider.

1. The study was conducted with a sample of only 60 secondary school teachers from Suti, Murshidabad, West Bengal.
2. The focus of the study was specifically on secondary school teachers' competencies in technology-enabled assessment, excluding other aspects of teaching

practice that may also influence students' holistic development.

3. The study only examined secondary school teachers' perceptions at a particular point in time, without investigating changes in competencies over an extended period.
4. The data collected through a self-constructed 5-point scale is based on self-reporting, which may lead to response biases such as social desirability or overestimation of competencies. Teachers may have provided answers they perceived to be ideal rather than their actual practices, potentially influencing the accuracy of the results.

These limitations suggest that while the findings are significant, further research with a larger and more diverse sample, as well as longitudinal studies, could provide a more comprehensive understanding of teachers' competencies in effective technology-enabled assessment for holistic development of students.

Conclusion

The study sheds light on the critical importance of teachers' competencies in effective technology-enabled assessment for the holistic development of students at the secondary level of school education. The findings highlight significant gaps in teachers' digital literacy and technological skills, as well as their lack of training in utilizing educational software and online platforms for assessments. This lack of proficiency hinders their ability to create engaging and personalized learning experiences for students. Furthermore, the study reveals that a majority of teachers struggle with analyzing and interpreting assessment data, limiting their capacity to identify students' strengths and areas for improvement. This deficiency hampers their ability to provide targeted feedback and interventions, impeding students' progress and growth. Innovative assessment designs that promote critical thinking, problem-solving, and collaboration are also lacking among the teachers surveyed. This highlights the need for professional development programmes that familiarize educators with cutting-edge assessment methods, such as gamified assessments and project-based evaluations, to enrich student learning experiences. Additionally, ethical considerations and data privacy concerns emerge as significant challenges for teachers. Many educators are unaware of the ethical dilemmas that may arise during technology-enabled assessments and lack the knowledge to navigate such situations responsibly.

In conclusion, the study underscores the urgency for comprehensive teacher training and professional development programmes that prioritize technology integration and digital literacy. Equipping teachers with the necessary competencies to leverage technology effectively will empower them to create engaging and personalized learning experiences, foster essential skills, and ensure the holistic development of their students. Addressing these competencies will not only shape the future of education but also prepare students to thrive in the digital age, becoming adaptable, critical thinkers, and responsible digital citizens. Policymakers, educational institutions, and stakeholders must collaborate to bridge these competency gaps and harness the full potential of technology-enabled assessment for the betterment of education.

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Research Article

Revolutionizing Higher Education: Integrating the Academic Bank of Credits (ABC) with MOOCs for Personalized, Flexible Learning and Enhanced Skill Development

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Abstract

The integration of the Academic Bank of Credits (ABC) and Massive Open Online Courses (MOOCs) aims to enhance flexibility, accessibility, and personalized learning in higher education. This study explores the experiences of Social Sciences students at the Central University of South Bihar with the ABC-MOOCs model, focusing on flexibility, workload management, content quality, technical challenges, and skill development. Using a mixed-methods approach, the study combines quantitative survey data with qualitative insights from open-ended responses and interviews. Findings indicate that while students appreciate the flexibility and personalized learning opportunities, challenges such as managing workloads, perceived lack of depth in some MOOCs, and technical issues hinder the model's effectiveness. Concerns about limited interaction in MOOCs also emerged, affecting collaborative learning. Despite these issues, students reported positive outcomes in skill development, particularly in data analysis and practical applications. The study concludes that improvements are needed to optimize the integration of ABC-MOOCs, including enhanced course quality, better workload support, improved infrastructure, and increased interactivity. These measures can foster a balanced, enriching learning experience that meets students' diverse academic and professional needs.

Keywords: Academic Bank of Credits (ABC), Massive Open Online Courses (MOOCs), Higher Education, Flexibility, Personalized Learning, Skill Development, Student Engagement, Social Sciences

Introduction

The integration of the Academic Bank of Credits (ABC) and Massive Open Online Courses (MOOCs) represents a transformative approach in Indian higher education, fostering flexibility and personalized learning pathways (Saleh et al., 2023). This model allows students to accumulate credits from diverse courses, enhancing their educational experiences while promoting lifelong learning. Feedback from Social Sciences students at the Central University of South Bihar highlights both the benefits and challenges associated with this integration. Students appreciate the opportunity to engage in interdisciplinary learning and explore subjects beyond traditional curricula (Adham, & Lundqvist, 2015). However, concerns persist regarding the quality and rigor of MOOCs compared to conventional courses, with many students perceiving MOOCs as lacking depth. This perception underscores the need for enhanced quality assurance to align online education with established academic standards (Williams, 2024). Technical barriers, such as unreliable

internet access and platform issues, have further complicated the learning experience, leading to disruptions that diminish the perceived value of online education (Nunes, 2004). Additionally, the absence of real-time interaction limits engagement, making it difficult for students to benefit from collaborative learning experiences typically found in classroom settings (Baporikar, 2016). Despite these challenges, positive outcomes are evident, particularly in skill acquisition through practical projects that connect theoretical knowledge to real-world applications. The ABC-MOOCs model has shown potential in bridging the gap between academic learning and career readiness (Yadav & Yadav, 2024). By addressing concerns about quality, accessibility, and interaction, educational institutions can enhance the effectiveness of the ABC-MOOCs integration, ensuring it meets the diverse needs of students in a rapidly evolving educational landscape.

Literature Review

The integration of the Academic Bank of Credits (ABC) and Massive Open Online Courses (MOOCs) represents a transformative shift in higher education, particularly in India. This model enhances flexibility, accessibility, and personalized learning by enabling students to accumulate credits across various institutions (Bhadri & Patil, 2022). As recent studies highlight, the integration of ABC and MOOCs presents significant opportunities and challenges, particularly concerning educational experiences, learning quality, and skill development (Jung & Lee, 2018).

Flexibility emerges as a central advantage of the ABC-MOOCs model, allowing students to design individualized learning paths that align with their interests and career aspirations. Research by (Zhang and Perris, 2023) indicates that this autonomy fosters a sense of ownership over education, enabling students to pursue diverse subjects. (Garg and Chauhan, 2024) further emphasize how flexible schedules cater to those juggling education, work, and family responsibilities. However, (Figueira and Almeida, 2022) argue that while MOOCs facilitate flexibility, they often lack adaptive technologies for deep personalization, suggesting a need for enhanced integration of individualized learning approaches within MOOCs (Kintu, et al., 2017).

Despite the apparent benefits, managing workload in a blended learning environment remains a significant challenge. (Kulkarni et al. 2023) observe that while the self-paced nature of MOOCs is advantageous, it can lead to increased stress and burnout when combined with traditional coursework. (Jones and Roberts, 2023) support this view, noting that students struggle to balance online and offline academic demands, which adversely affects learning outcomes. This feedback from Social Sciences students at the Central University of South Bihar underscores the necessity for effective workload management strategies tailored to this unique educational landscape.

Concerns regarding the quality and depth of MOOCs persist, particularly as they relate to the rigour expected in higher education. (Li and Zhao, 2023) note that many MOOCs are often perceived as superficial, focusing predominantly on introductory content. (Wilkins and Ahn, 2022) stress the importance of robust quality assurance mechanisms to ensure alignment with university curricula. Students at the Central University of South Bihar echo these sentiments, highlighting that certain MOOCs lack the depth and thoroughness of traditional courses. Understanding how perceptions of course quality influence student

engagement and satisfaction is crucial for optimizing the ABC-MOOCs integration (Williams, 2024).

Technical challenges also pose significant barriers to effective online learning. (Hossain et al. 2023) identify that students in regions with limited digital infrastructure face considerable obstacles, including poor internet connectivity and platform usability issues (Williams, 2024). These technical difficulties disrupt learning and diminish the perceived value of online education. Students at the Central University of South Bihar frequently report issues related to unreliable internet access and platform glitches, which hinder their ability to engage fully in MOOCs. Addressing these technical challenges is essential for improving accessibility and the overall user experience of online education (Sebbeq & Faddouli, 2020).

Engagement and interaction in MOOCs compared to traditional classroom settings, are critical areas of concern. (Al-Samarraie et al. 2023) and (Liu and Chen, 2022) find that the absence of real-time discussions and direct interaction with instructors can lead to feelings of isolation, which diminishes student motivation (Ogunyemi, et al., 2022). The asynchronous nature of many MOOCs limits collaborative learning opportunities, particularly vital in Social Sciences education. Feedback from students at the Central University of South Bihar reveals that the lack of classroom discussions and personalized guidance makes the online learning experience less fulfilling (Wang et al., 2022). This highlights the need for strategies to enhance engagement and interaction in online course designs.

Finally, skill development remains a key benefit of MOOCs when they incorporate practical assignments and case studies. (Pappano and Silvernail, 2023) demonstrate that project-based MOOCs significantly enhance practical skills relevant to various fields. Students at the Central University of South Bihar report that projects in MOOCs have equipped them with skills applicable to their academic and professional pursuits (Sunar et al., 2016). This reinforces the necessity for further research to understand how these skills translate into real-world contexts.

Overall, the literature indicates that the ABC-MOOCs integration has the potential to significantly improve higher education by increasing flexibility and promoting skill development (Fantinelli et al., 2024). Nonetheless, challenges related to workload management, quality assurance, technical infrastructure, and student engagement must be addressed (Dagenais et al., 2024). This study aims to explore the specific experiences and perceptions of Social Sciences students at the Central University of South Bihar, offering valuable insights into optimizing the ABC-MOOCs integration for better educational outcomes.

Synthesis and Gap Identification

The literature provides a foundational understanding of the individual components—ABC, MOOCs, and personalized learning. However, there is a notable gap in comprehensive studies exploring the combined impact of integrating ABC and MOOCs on students' learning experiences and skill acquisition, particularly within diverse Social Sciences programs. This study seeks to address this gap by examining the interplay between ABC and MOOCs and its implications for students across various disciplines.

Need and Significance of The Study

The integration of the Academic Bank of Credits (ABC) and Massive Open Online Courses (MOOCs) signifies a transformative shift in higher education,

providing students with flexible, accessible pathways to accumulate credits and pursue personalized learning (Mutawa, 2023). This model aims to broaden educational access and foster lifelong learning by allowing students to select courses from diverse institutions, aligning their educational journey with personal interests and career goals. Given the growing prominence of ABC-MOOCs, particularly in India, there is a need to assess its impact on student experiences, skill acquisition, and satisfaction. Understanding these aspects is essential for optimizing the system and addressing challenges to ensure it meets its intended objectives (Bartolomé et al., 2018). This study focuses on Social Sciences students at the Central University of South Bihar, a group whose specific needs in the context of ABC-MOOCs integration have not been thoroughly explored. Key areas such as workload management, course quality, and personalization of learning are examined, providing insights into the unique challenges and benefits of this model. Additionally, the study investigates technical infrastructure issues that could hinder effective online learning, emphasizing the need for robust digital resources (Buhl & Andreasen, 2018). By exploring how students apply skills gained from MOOCs in real-world contexts, this research highlights the practical value of ABC-MOOCs integration, offering guidance to educators, policymakers, and administrators to refine and enhance online learning strategies for broader, more inclusive educational outcomes (Marienko et al., 2020).

- Research Questions
- How do students perceive the integration of Academic Bank of Credits (ABC) and MOOCs within their educational journey?
- What is the impact of ABC and MOOCs on the development of key skills such as research, critical thinking, communication, and interdisciplinary learning among students?
- How do individualized learning paths enabled by ABC and MOOCs affect student engagement, motivation, and their sense of ownership over their learning process?

Objectives of the study

- Explore how students perceive the integration of Academic Bank of Credits (ABC) and Massive Open Online Courses (MOOCs) in their overall educational experience.
- Evaluate the impact of ABC and MOOCs on students' skill acquisition, focusing on research, critical thinking, communication, and interdisciplinary competencies.
- Investigate the influence of individualized learning paths facilitated by ABC and MOOCs on student engagement, motivation, and ownership of their education.

Methodology

This study utilizes a mixed-methods approach to evaluate the integration of the Academic Bank of Credits (ABC) and Massive Open Online Courses (MOOCs) at the Central University of South Bihar, focusing on student experiences. By combining quantitative and qualitative data, the research aims to provide a comprehensive understanding of how ABC and MOOCs impact flexibility, workload management, skill development, and personalized learning. The sample comprised 186 students for a questionnaire survey and 40 students for semi-structured interviews, specifically from Social Sciences programs such as Economics, Psychology, Sociology, Political Science, Hindi, History, and English. Purposive sampling ensured that interview

participants had relevant exposure to ABC and MOOCs, while simple random sampling captured a broader perspective for the surveys.

An expert review process was implemented to validate research instruments, refining survey and interview questions to align with the research objectives. Data collection methods included surveys, open-ended questionnaires, and semi-structured interviews. Quantitative data were analyzed using descriptive statistics to identify trends, while qualitative data were examined thematically to extract key themes. The study is delimited to Social Sciences students, focusing on self-reported experiences rather than academic performance metrics, which may limit generalizability. Ethical considerations were strictly adhered to, ensuring informed consent, anonymity, and the right to withdraw, ultimately providing valuable insights into the strengths and challenges of ABC and MOOCs integration in higher education.

Data Analysis and Interpretation

Section A: Analysis of Student Perceptions, Skill Acquisition, and Individualized Learning Paths with ABC and MOOCs Integration

The integration of the Academic Bank of Credits (ABC) and Massive Open Online Courses (MOOCs) in educational systems provides various opportunities and challenges. Based on the data collected through field surveys, three aspects—student perceptions, skill acquisition, and individualized learning paths—were analyzed to understand the overall impact.

Table-1: Assess Student Perceptions (ABC and MOOCs Integration)

Sl. No	Particulars	Strongly Agree	Agree	Uncer-tain	Disagree	Strongly Disagree	Mean	S. D	Decision
1.	To what extent do you agree that the integration of ABC and MOOCs provides flexibility in pursuing your education?	41(22.0)	54(29.0)	54(29.0)	32(17.2)	5(2.7)	3.50	1.09	High
2.	To what extent do you agree that the content of MOOCs contributes to your academic and career goals?	38(20.4)	68(36.6)	48(25.8)	27(14.5)	5(2.7)	3.57	1.05	High
3.	To what extent do you agree that the MOOCs offered through ABC are accessible in terms of language, technology, and ease of enrollment?	21(11.3)	57(30.6)	60(32.3)	44(23.7)	4(2.2)	3.25	1.01	Low
4.	To what extent do you agree that transferring credits from MOOCs through ABC is a straightforward and efficient process?	45(24.2)	58(31.2)	49(26.3)	28(15.1)	6(3.2)	3.58	1.10	High

Sl. No	Particulars	Strongly Agree	Agree	Uncer-tain	Disagree	Strongly Disagree	Mean	S. D	Decision
5.	To what extent do you agree that the quality of MOOCs integrated into ABC is comparable to traditional classroom-based courses?	25(13.4)	36(19.4)	42(22.6)	67(36.0)	16(8.6)	2.93	1.19	Low
6.	To what extent do you agree that you are satisfied with the overall integration of ABC and MOOCs in your educational experience?	27(14.5)	52(28.0)	59(31.7)	46(24.7)	2(1.1)	3.30	1.03	Low
7.	To what extent do you agree that the certifications and credits earned through MOOCs are valuable and recognized by educational institutions and employers?	31(16.7)	43(23.1)	67(36.0)	40(21.5)	5(2.7)	3.29	1.06	Low
8.	To what extent do you agree that the integration of ABC and MOOCs provides you with flexibility to choose courses aligned with your personal and professional interests?	49(26.3)	61(32.8)	46(24.7)	25(13.4)	5(2.7)	3.66	1.08	High

Note: Numbers in parenthesis are in percentage, Decision- Weighted Average=27.08/8=3.38 Source: Field Survey

The data in Table 1 assesses student perceptions of integrating the Academic Bank of Credits (ABC) and MOOCs, highlighting flexibility, content relevance, accessibility, credit transfer, quality, satisfaction, and certification recognition. The analysis reveals mixed results; students perceive the integration as enhancing flexibility (mean: 3.50) and aligning with personal and professional interests (mean: 3.66). The contribution of MOOCs to academic and career goals (mean: 3.57) and the credit transfer process (mean: 3.58) received positive ratings. However, concerns about accessibility (mean: 3.25) emerge, particularly regarding language, technology, and enrolment challenges. The quality of MOOCs compared to traditional courses (mean: 2.93) and overall satisfaction with the integration (mean: 3.30) also show dissatisfaction. The overall weighted average of 3.38 indicates moderate satisfaction, emphasizing strengths in flexibility and credit transfer while highlighting the need for improvements in accessibility, quality, and certification recognition.

Table-2: Measure Impact on Skill Acquisition (Research, Critical Thinking, Communication, and Interdisciplinary Skills)

Sl. No	Particulars	Strongly Agree	Agree	Uncer-tain	Disagree	Strongly Disagree	Mean	S. D	Decision
1.	To what extent do you agree that ABC and MOOCs have enhanced your ability to conduct research and engage in critical thinking?	49(26.3)	51(27.4)	50(26.9)	33(17.7)	3(1.6)	3.59	1.10	High
2.	To what extent do you agree that the integration of ABC and MOOCs has improved your communication skills and ability to collaborate in a multidisciplinary environment?	50(26.9)	57(30.6)	46(24.7)	29(15.6)	4(2.2)	3.64	1.10	High
3.	To what extent do you agree that ABC and MOOCs have improved your ability to analyze and solve complex problems?	44(23.7)	51(27.4)	52(28.0)	34(18.3)	5(.27)	3.51	1.12	Low
4.	To what extent do you agree that ABC and MOOCs have strengthened your ability to understand and integrate knowledge across different disciplines?	52(28.0)	62(33.3)	45(24.2)	25(13.4)	2(1.1)	3.73	1.04	High
5.	To what extent do you agree that ABC and MOOCs have developed your ability to learn independently and take responsibility for your own learning?	42(22.6)	55(29.6)	52(28.0)	35(18.8)	2(1.1)	3.53	1.07	Low
6.	To what extent do you agree that ABC and MOOCs have enhanced your ability to apply theoretical knowledge to practical, real-world situations?	56(30.1)	55(29.6)	49(26.3)	23(12.4)	3(1.6)	3.74	1.06	High

Sl. No	Particulars	Strongly Agree	Agree	Uncer-tain	Disagree	Strongly Disagree	Mean	S. D	Decision
7.	To what extent do you agree that the integration of ABC and MOOCs has provided opportunities for collaborative research with peers or faculty?	37(19.9)	45(24.2)	58(31.2)	43(23.1)	3(1.6)	3.37	1.09	Low

Note: Numbers in parenthesis are in percentage, Decision- Weighted Average=25.11/7=3.58 Source: Field Survey

While Table 2 highlights the evaluates the impact of ABC and MOOCs on skill acquisition, specifically research, critical thinking, communication, problem-solving, interdisciplinary understanding, and practical application. The analysis shows positive outcomes in key areas. Students report significant enhancement in their research and critical thinking abilities (mean: 3.59), communication and collaboration skills (mean: 3.64), interdisciplinary knowledge integration (mean: 3.73), and applying theoretical knowledge to real-world situations (mean: 3.74). However, there are mixed perceptions regarding independent learning (mean: 3.53) and problem-solving (mean: 3.51), which are rated lower. Opportunities for collaborative research are viewed less positively (mean: 3.37). The overall weighted average of 3.58 indicates that ABC and MOOCs are generally effective in improving key skills, though areas like problem-solving and research collaboration need attention.

Table-3: Explore Individualized Learning Paths (Engagement, Motivation, and Ownership of Learning)

Sl. No	Particulars	Strongly Agree	Agree	Uncer-tain	Disagree	Strongly Disagree	Mean	S. D	Decision
1.	To what extent do you agree that ABC and MOOCs have empowered you to design your own learning path and take responsibility for your educational outcomes?	59(31.7)	65(34.9)	49(26.3)	10(5.1)	3(1.6)	3.89	.96	High
2.	To what extent do you agree that the flexible, individualized learning paths provided by ABC and MOOCs have increased your motivation and engagement in your educational journey?	49(26.3)	73(39.2)	41(22.0)	19(10.2)	4(2.2)	3.77	1.02	High

Sl. No	Particulars	Strongly Agree	Agree	Uncer-tain	Disagree	Strongly Disagree	Mean	S. D	Decision
3.	To what extent do you agree that the integration of ABC and MOOCs has increased your autonomy in deciding what, when, and how you learn?	64(34.4)	73(39.2)	34(18.3)	11(5.9)	4(2.2)	3.97	.98	High
4.	To what extent do you agree that ABC and MOOCs allow you to customize your learning experience based on your personal interests and career goals?	35(18.8)	70(37.8)	48(25.8)	29(15.6)	4(2.2)	3.55	1.03	Low
5.	To what extent do you agree that the integration of ABC and MOOCs has enhanced your engagement with learning materials and resources?	52(28.0)	67(36.0)	45(24.2)	17(9.1)	5(2.7)	3.77	1.04	High
6.	To what extent do you agree that ABC and MOOCs have provided you with control over the pace at which you complete your courses and learning tasks?	39(21.0)	62(33.3)	45(24.2)	38(20.4)	2(1.1)	3.52	1.07	Low
7.	To what extent do you agree that the individualized learning paths offered by ABC and MOOCs have increased your motivation to continue learning throughout your life?	51(27.4)	77(41.4)	42(22.6)	14(7.5)	2(1.1)	3.86	.94	High

Note: Numbers in parenthesis are in percentage, Decision- Weighted Average=26.33/7=3.76 Source: Field Survey

Table 3, on the other hand, highlights the data and explores how ABC and MOOCs impact individualized learning paths, focusing on engagement, motivation, and ownership of learning. Overall, students express positive perceptions. The ability to design their own learning path and take responsibility for outcomes is highly rated (mean: 3.89), along with increased autonomy in deciding what, when, and how to learn (mean: 3.97). The flexible learning paths have also enhanced motivation and engagement (mean: 3.77) and encouraged lifelong learning (mean: 3.86). However, there is some uncertainty regarding customization based on personal interests (mean: 3.55) and control over the pace of learning (mean: 3.52), which are rated lower. The weighted average of 3.76 reflects strong support for individualized learning,

although areas like course pacing and personalization could be improved for greater effectiveness.

Section B:

This analysis of feedback from 40 Social Sciences students at the Central University of South Bihar provides a comprehensive insight into the integration of the Academic Bank of Credits (ABC) and Massive Open Online Courses (MOOCs) within their educational experience. Key findings across different programs can be summarized as follows:

Table-4: "How would you describe your overall experience with the integration of Academic Bank of Credits (ABC) and Massive Open Online Courses (MOOCs) in your education?" from 40 students at the Central University of South Bihar, enrolled in various Social Sciences programs

Social Sciences participants	Flexibility and Convenience	Challenges in Balancing Workload	Quality and Depth of MOOCs	Technical Difficulties	Lack of Interaction and Engagement
M.A. Economics	"The flexibility to choose courses through ABC was great."	"Balancing online MOOCs with regular coursework was difficult."	"The quality of some MOOCs was lower than expected."	"I frequently encountered technical issues that made accessing some MOOCs difficult."	"I missed the personal guidance and interaction that are part of traditional classroom learning."
M.A. Psychology	"I enjoyed being able to take a variety of MOOCs."	"I struggled to keep up with the workload of both MOOCs and regular classes."	"I found that the online format of MOOCs didn't match the engagement of traditional classes."	"I faced numerous technical challenges that negatively impacted my learning process."	"I found the online courses less engaging due to the absence of classroom discussions."
M.A. Sociology	"MOOCs gave me access to international resources."	"I found it difficult to stay motivated in the self-paced format of MOOCs."	"I felt that the online courses lacked depth."	"Technical difficulties were a persistent problem that affected my ability to keep pace with my studies."	"The lack of student-teacher interaction in MOOCs made the learning experience feel less fulfilling."
M.A. Pol. Science	"Being able to accumulate credits from MOOCs was helpful."	"I felt disconnected from my classmates and professors during the online courses."	"The quality of some MOOCs was not as high as our in-class courses."	"The online platform's accessibility issues created obstacles in my coursework."	"The lack of real-time interaction with professors in MOOCs was a downside compared to traditional classes."
M.A. Hindi	"I appreciate the academic freedom ABC gave me."	"The workload of managing both was difficult."	"The content of some online courses was too basic for me."	"Navigating the technology used for MOOCs was often frustrating and time-consuming."	"MOOCs felt more detached because there wasn't the same level of interaction as in physical classes."

Social Sciences participants	Flexibility and Convenience	Challenges in Balancing Workload	Quality and Depth of MOOCs	Technical Difficulties	Lack of Interaction and Engagement
M.A. History	"ABC helped me choose courses more suited to my interests."	"The content of some online courses was too basic for me."	"Some MOOCs felt too general compared to our specialized subjects."	"The technical issues I faced during online classes often disrupted my focus and motivation."	"I struggled to stay engaged in MOOCs since there were no interactive elements like in-person discussions."
M.A. Pol. Science	"The flexibility of MOOCs was helpful."	"Balancing the workload of MOOCs and my classes was difficult."	"I wish there were more advanced MOOCs available; some were too basic."	"The reliability of the platform used for MOOCs was inconsistent, making it hard to participate effectively."	"The absence of classroom discussions and direct engagement with professors made MOOCs less appealing."
M.A. Sociology	"ABC allowed me to earn credits outside my major."	"I found that some MOOCs were too basic for my level."	"Some MOOCs lacked depth, especially compared to our university classes."	"Poor internet connectivity was a significant barrier that hindered my experience with MOOCs."	"I missed the personal interaction with classmates and instructors, which made MOOCs feel isolating."
M.A. English	"I liked the variety of subjects offered by MOOCs."	"I found it challenging to manage the workload from both MOOCs and my regular classes."	"I felt the quality of some MOOCs wasn't as rigorous as our university curriculum."	"Technical difficulties often disrupted my ability to fully engage with online courses."	"MOOCs lacked the depth of interaction that we usually have in our university courses, which affected my learning experience."

Table 4 illustrates the feedback from 40 Social Sciences students at the Central University of South Bihar, highlighting both the benefits and challenges of integrating ABC and MOOCs. Students value the flexibility and variety of courses, particularly the ability to choose subjects based on their interests. However, balancing the workload of MOOCs with regular coursework was a common struggle, leading to stress. Concerns were raised about the quality and depth of MOOCs, with some courses perceived as too basic. Technical issues, such as unreliable platforms and poor internet connectivity, along with a lack of interaction, further hindered the learning experience.

Table-5: A qualitative analysis of responses to the question "How do you think the integration of ABC and MOOCs has contributed to your understanding of course materials and subjects?" from 40 students enrolled in various Social Sciences programs at the Central University of South Bihar revealed the following insights

Common Themes	Observation	Respond
Diversification of Perspectives	Many students reported that the integration of Academic Bank of Credits (ABC) and MOOCs broadened their perspectives on course materials by providing additional viewpoints and supplementary content from different sources and disciplines.	"In the M.A. in Political Science, the MOOCs covered international perspectives not fully addressed in our regular classes. It enriched my understanding of global political dynamics."
Enhanced Depth of Knowledge	Students often noted that MOOCs contributed to a more in-depth understanding of specific topics, allowing them to explore subjects in greater detail beyond the scope of their regular coursework.	"Being in the M.A. in History program, the MOOCs delved into specific historical events in detail, offering a richer context that complemented our broader curriculum."
Application of Theoretical Concepts	Several participants mentioned that the integration facilitated the application of theoretical concepts learned in class to real-world scenarios, making the learning experience more practical.	"As an M.A. in Economics student, the MOOCs provided real-world case studies, helping me apply economic theories to current economic issues and policies."
Interdisciplinary Connections	Students appreciated how the integration helped them make interdisciplinary connections between their core subjects and other areas of study, fostering a holistic understanding.	"The M.A. in Sociology program benefited from MOOCs that explored sociological aspects in tandem with other disciplines, creating a more interconnected knowledge base."
Individualized Learning Paths	Some participants highlighted that the integration allowed for individualized learning paths, enabling them to explore specific topics of personal interest within their academic discipline.	"In the M.A. in Psychology program, the flexibility of MOOCs let me focus on specific areas of psychology that aligned with my career goals, adding depth to my studies."

Table 5, on the other hand, highlights the qualitative analysis of responses from 40 Social Sciences students at the Central University of South Bihar, revealing the key benefits of integrating ABC and MOOCs. Students appreciated the diversification of perspectives, particularly through international viewpoints and supplementary content that enriched their understanding. The depth of knowledge gained through MOOCs allowed for deeper exploration of topics, while real-world case studies helped bridge theory and practice. The integration also fostered interdisciplinary connections and personalized learning paths, allowing students to tailor their studies to personal interests and career goals. Overall, the integration enhanced both academic depth and practical understanding.

Table-6: A qualitative analysis of responses to the question to what extent do you feel that the integration of ABC and MOOCs has personalized your learning experience? Can you provide responses? From 40 students at the Central University of South Bihar enrolled in various Social Sciences programs

Common Themes	Observation	Respond
Flexible Learning Paths	Many students expressed appreciation for the personalized learning paths facilitated by MOOCs, allowing them to explore specific areas of interest at their own pace.	"In the M.A. in English program, the MOOCs offered a range of literature courses, letting me personalize my learning journey by selecting topics aligned with my literary interests."
Tailored Skill Development	Participants often noted that the integration allowed for the customization of skill development, enabling them to focus on areas that aligned with their career aspirations.	"As an M.A. in Psychology student, the integration allowed me to choose MOOCs that specifically enhanced my research skills, aligning with my career goal of becoming a researcher."
Individualized Research Opportunities	Some students highlighted the personalized nature of research opportunities, where they could explore specific topics in-depth, enhancing their understanding.	"In the M.A. in Sociology program, the integration provided research-oriented MOOCs that allowed me to delve into niche sociological areas, making my research more personalized."
Catering to Varied Learning Styles	Participants noted that the integration accommodated different learning styles, providing diverse resources such as videos, articles, and interactive content.	"For M.A. in Political Science, the MOOCs included multimedia content, catering to various learning styles and making the learning experience more personalized."
Adaptability to Personal Schedules	Students highlighted how the integration allowed them to adapt their learning to personal schedules, especially beneficial for those with part-time jobs or other commitments.	"In the M.A. in Hindi program, the flexibility of MOOCs helped me balance my studies with work commitments, making my learning experience more personalized and adaptable."

While Table 6 highlights the qualitative analysis from 40 Social Sciences students at the Central University of South Bihar, which shows that the integration of ABC and MOOCs has personalized their learning experiences. Students appreciated the flexible learning paths, which allowed them to explore topics at their own pace and focus on skills aligned with their career goals. The integration catered to different learning styles and personal schedules, making learning more engaging and adaptable, ultimately enhancing both academic and personal development.

Table-7: A qualitative analysis of responses to the question: Can you describe any specific projects or assignments from MOOCs that you believe enhanced your practical skills or knowledge? From 40 students at the Central University of South Bihar, enrolled in various Social Sciences programs

Common Themes	Respond
Data Analysis and Visualization	"I undertook a project in a data analytics MOOC where I had to analyze economic indicators and present the findings visually. This enhanced my practical skills in data interpretation. (M.A. in Economics): "
Literary Critique and Creative Writing	"A MOOC project required us to analyze a classic novel and create a modern adaptation. This project honed my creative writing skills and deepened my literary analysis (M.A. in English)."
Historical Research and Archival Work	"A MOOC on ancient civilizations required a project researching primary sources. It gave me hands-on experience with historical research and archival analysis. (M.A. in History): "
Policy Analysis and Simulation	"We conducted a policy simulation project in a political science MOOC, analyzing the impact of proposed policies. This practical exercise improved my policy analysis skills. (M.A. in Political Science)"

Table 7 shows on the analysis of responses from 40 Social Sciences students at the Central University of South Bihar shows that MOOCs projects have significantly enhanced practical skills. Economics students improved data analysis, English students honed creative writing, History students gained archival research experience, and Political Science students sharpened policy analysis skills. These projects linked theory to real-world practice.

Table-8: A qualitative analysis of responses to the question: Can you share responses of how the skills acquired through ABC and MOOCs have been applicable in your academic or professional life? From 40 students at the Central University of South Bihar enrolled in various Social Sciences programs

Common Themes	Respond
Research Skills in Academic Writing	"The research skills I honed in a literature analysis MOOC have been crucial in my academic writing, allowing me to conduct thorough literature reviews for my M.A. thesis (M.A. in English)."
Data Analysis Skills in Economic Research	"The data analysis techniques learned in a MOOC have been invaluable in my economic research projects. I can now analyze economic data more effectively (M.A. in Economics)."
Language Proficiency in Translation Work	"The language enhancement MOOC directly improved my translation skills. I now work as a translator, and the proficiency gained has been beneficial in my professional life (M.A. in Hindi)."
Policy Analysis in Government Internships	"The policy analysis skills from a MOOC were instrumental in my government internship. I could contribute effectively to analyzing and formulating policies (M.A. in Political Science)."

Common Themes	Respond
Psychological Research Skills in Clinical Setting	"The research methods MOOC greatly enhanced my psychological research skills. I now apply these skills in a clinical setting, improving patient assessments (M.A. in Psychology):"

Table 8 further show the analysis of 40 Social Sciences students at the Central University of South Bihar reveals that skills gained through ABC and MOOCs have practical applications. Research, data analysis, and language skills have enhanced students' academic work, professional translation, clinical assessments, and contributions to policy formulation through internships.

Findings and Discussion

The integration of ABC and MOOCs has been met with both positive and critical feedback from students, as reflected in the field survey data and interviews.

The integration of the Academic Bank of Credits (ABC) and Massive Open Online Courses (MOOCs) has generated both positive and critical responses from students at the Central University of South Bihar, particularly among those in Social Sciences programs. A survey revealed that while students appreciate the flexibility offered by these platforms, challenges regarding workload management and the quality of MOOCs remain prominent. Students indicated a strong preference for autonomy in selecting courses that align with their academic and professional interests. The average mean scores of 3.50 for flexibility and 3.66 for alignment with personal goals underscore the importance of such options. However, many expressed difficulty balancing MOOCs with traditional coursework, which increased stress and feelings of isolation. This suggests that while flexibility is a significant advantage, it can also lead to challenges that impact student well-being.

Concerns about the quality of MOOCs were also evident, with a mean score of 2.93 indicating perceptions of inferior rigour compared to traditional courses. Technical issues and a lack of interaction detracted from the learning experience, highlighting a critical gap between online and in-person education. This lack of engagement contributed to students feeling disconnected from their peers and instructors, revealing that the effectiveness of MOOCs in enhancing educational experiences may be limited without sufficient interactive components. Despite these challenges, the integration of ABC and MOOCs has fostered interdisciplinary connections and a richer understanding of course materials. Students reported that exposure to diverse perspectives enhanced their academic discussions, enabling them to apply theoretical concepts to real-world scenarios. Furthermore, the personalized learning paths afforded by ABC and MOOCs were appreciated, allowing students to pursue their interests and tailor their education to fit individual career aspirations.

Overall, the integration of ABC and MOOCs presents a mixed landscape of opportunities and challenges. While students benefit from flexibility and personalized learning experiences, concerns about workload, course quality, and social engagement need to be addressed. Fostering a more balanced approach to these challenges will enhance the educational experience and ensure that the integration effectively meets the evolving needs of students in the Social Sciences.

Suggestions

To enhance the integration of the Academic Bank of Credits (ABC) and Massive Open Online Courses (MOOCs) at the Central University of South Bihar, a multifaceted approach addressing student feedback is essential. The analysis of student perceptions indicates several key areas for improvement.

- Quality Control for MOOCs is paramount. The relatively low ratings for MOOC quality (mean: 2.93) highlight the need for a robust review system that ensures these courses match the rigour of traditional offerings. Collaborating with academic departments to align MOOC content with existing curricula will enhance their relevance and academic challenge.
- Technical Support and Resources must also be prioritized. Students reported frustrations with online platforms due to technical difficulties. Providing comprehensive tutorials and workshops can empower students to navigate these platforms effectively, minimizing barriers to access.
- Facilitating Interaction and Engagement within MOOCs is crucial for enhancing the learning experience. The absence of peer interaction and instructor engagement can lead to feelings of isolation. Introducing virtual discussion forums and live Q&A sessions will foster a sense of community. Additionally, incorporating group projects and peer review assignments can encourage collaborative learning.
- Workload Management is another significant concern. Many students struggle to balance MOOCs with their traditional coursework, leading to stress. Institutions should develop structured schedules and guidelines that help students manage their workload, ensuring a more balanced educational experience.
- Expanding the Diverse Learning Resources available within MOOCs can cater to varied learning styles. By integrating more multimedia content and interactive elements, the learning experience becomes more engaging and personalized, thus increasing student satisfaction.
- Personalized Learning Pathways can further enhance the educational experience. Providing tools for students to customize their learning paths based on individual interests and career aspirations will foster deeper engagement with the material.
- Implementing a Feedback Mechanism for Continuous Improvement is also vital. A robust system that allows students to share their experiences and suggestions will enable institutions to adapt and refine MOOCs to better meet student needs.
- Lastly, emphasizing Career Guidance and Application of Skills learned through MOOCs will bridge the gap between education and professional development. Workshops connecting students with industry professionals can illuminate the practical application of skills acquired through these courses.

By addressing these critical areas, the integration of ABC and MOOCs can be optimized, enhancing both academic performance and the overall student experience. This comprehensive approach will not only improve student satisfaction but also equip learners with the necessary skills for their future careers.

Concluding Remarks

The integration of the Academic Bank of Credits (ABC) and Massive Open Online Courses (MOOCs) at the Central University of South Bihar represents a significant advancement in education for Social Sciences students. This approach provides students with essential flexibility and autonomy, enabling them to tailor their learning experiences to align with personal and professional objectives. The positive feedback regarding skill acquisition, particularly in research and interdisciplinary knowledge, highlights the potential of MOOCs to enhance both academic understanding and practical application. However, several challenges remain that require attention. Accessibility issues, concerns about the perceived quality of MOOCs, and the difficulty of balancing workloads indicate the need for continuous improvement. Students have expressed a strong desire for greater interaction, collaboration, and support, emphasizing the importance of creating an inclusive and engaging learning environment. To optimize the integration of ABC and MOOCs, institutions must focus on enhancing course quality, improving accessibility, and bolstering student support mechanisms. By addressing these concerns and implementing targeted improvements, educational institutions can create a more effective framework that meets the diverse needs of students, ultimately enriching their learning experiences and preparing them for the complexities of the modern world.

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Research Article

Blogging during the Pandemic: An Action Research

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Abstract

The paper focuses on the advantages of using a class blog to improve the writing skills of postgraduate literature students. The pandemic enabled all the learners to use technology uniformly, and therefore, it was possible to use a class blog to improve the writing skills of the learners. An action research was planned and conducted to improve the engagement level of the postgraduate students during the pandemic and also to enhance their writing skills as well. Feedback was collected at the end of the semester to gauge the impact of using blogs in the classroom. The usage data retrieved from the class blog has also been analyzed quantitatively to measure the engagement level of the learners. Both the quantitative and the qualitative data obtained at the end of the semester show improvement in the engagement level of the learners. The writing skills of a few of the learners showed considerable improvement. The action research revealed that the opportunity provided boosted the confidence of the majority of the learners in the classroom in expressing their thoughts in writing. The reflection of the teacher and learners revealed the positive impact of feedback on the entire writing process.

Keywords: Class Blog, Technology Enhanced English Language learning, blended learning, pandemic Learning, English Writing skills, Feedback, Engagement, WhatsApp Voice notes

Introduction

The pandemic has forced traditional English classrooms to transform into technology-enhanced language teaching and learning spaces. The English language and teaching in India were largely confined to brick-and-mortar learning spaces prior to the pandemic; however, the pandemic forced teachers to adopt an online, blended learning model. The necessity of continuing teaching and learning during the pandemic has forced the teachers and administrators of colleges to adopt online learning and teaching with alacrity despite the financial and infrastructural challenges involved in setting it up. This paper describes the teaching and learning of English using a classroom blog and focuses on the advantages of using a class blog to improve the writing skills of postgraduate students of Literature. The pandemic enabled all the learners to use technology uniformly, and therefore, it was possible to use a class blog to improve the writing skills of the learners.

Literature Review

Blogs or weblogs are interactive online journals that can be used in language classrooms to improve the writing skills of the learners. It facilitates meaningful and engaging discussion (Jan Lacina, J and Griffith, R (2012) among peers and

between the teacher and the learners. Blogging, which promotes collaborative learning, helps the learners to co-construct knowledge along with their peers. Christina Melly (2018) used classroom blogging to give practice in writing to ninth-grade high school at St. Louis, Missouri. In her study, more than the grading, she found that peer feedback provided the necessary impetus for the learners to continue blogging. Kendra N. Bryant (2013) used classroom blogging to improve the engagement and writing skills of her learners and created an embodied learning environment in her classroom.

Linda Carol Jones and Amalie Holla(2013) conducted an experimental study with 18 students who were enrolled in two different courses at a Midwest American University and found a strong correlation between personality and participation in blogging activity in an academic setting. The researchers used the Big Five personality inventory that had previously helped researchers identify the association of openness, agreeableness, neuroticism, extraversion, and conscientiousness with social blogging. The study tracked the blogging habits of the students with their personality types and found that the students who chose to blog were high in extraversion and high in neuroticism. Ahluwalia, G., Gupta, D., & Aggarwal, D., (2011) used blogs as a means to supplement in-class language learning activities. The experimental study was conducted with 42 first-year Engineering College learners through a survey and the learners' perception of using blogs was measured, and their motivation increased. In 2008, the Pew Internet, along with the American Life Project and the National Commission on Writing, conducted a research study to find out the impact of technology on writing. The study found that teen bloggers, in particular, engaged in a wide range of writing outside of school, like short writing, journal writing, creative writing, letter writing, and music or lyrics writing. Compared to non-bloggers, Teen Bloggers were more productive outside of school and wrote more frequently than other teens. Previous studies in using blogs in second language teaching and learning contexts show that more research is needed to understand the complex relationship between blogging, personality, and motivation.

This action research attempted to gauge the engagement of the learners while using blogs. Student engagement in academic environments like schools (Parsons, S. A., Nuland, L. R., & Parsons, A. W., 2014; Wang, M.-T., & Holcombe, R., 2010; Freedricks, J. A., Blumenfeld, P. C., & Paris, A. H. 2004) and colleges (Li, M., Yu, L., Qin, Y., Lu, P., & Zhang, X., 2016; Tsai, S., & Wu, T. 2019) and online learning environments (Herridge, A. S., McNaughtan, J., & James, L. J., 2020; Bodily, R., Charles R.G, C.R., and Bush, M.D.,2017) has been discussed adequately even before the pandemic. However, this study attempts to throw light on student engagement in the online environment during the pandemic in particular. The term student engagement has been interpreted in different ways by varied academicians and researchers, and Jonasson, C. (2012) points out how even among the teachers and students, there is a divergent perception with regard to the term 'engagement'. Student engagement in an online environment refers to both cognitive and affective engagement of the learners in an academic activity. The online environment with relevant content would not only promote deep learning but also motivate the learners to persist and be consistent in their online academic activity. Jennifer A Fredricks et.al., recommend studying student engagement as a multifaceted construct that involves behavioral, emotional, and cognitive engagement. Behavioural engagement

refers to appropriate task behaviour by following the rules, completing tasks within the given timelines with involvement in the learning process, and active and consistent participation in academic discussions with peers and teachers. Emotional Engagement refers to the interest and investment that the learners have in participating and completing a learning activity. It is the "student's psychological investment in an effort directed toward learning, understanding, mastering the knowledge, skills or crafts that the academic work is intended to promote" (Newmzann, F., Wehlage, G. G., & Lamborn, S. D., 1992). Cognitive engagement refers to motivation to learn with persistence, self-regulated efforts to understand, learn and complete the given task and awareness and voluntary use of learning strategies. Julianne C. Turner (1995), who equates motivation to cognitive engagement in her research study, identified categories of behaviour during reading activities, namely the use of reading strategies, the use of learning strategies, evidence of volitional control strategies, and evidence of persistence. The finding of the study suggested that the "motivation is neither in the student nor in the program, but in each child's encounter with the reading and writing task" (Turner, J. C. 1995). In this study, the engagement level of the learners is interpreted based on the behavioural, emotional and cognitive engagement of the participants.

A field quasi-experiment was carried out by Yu-Min Wang and Chei-Chang Chiou (2022) to examine the efficacy of blog teaching in higher education. According to the study, integrating blogs into university instruction improves students' achievement and sense of fulfilment from their studies. The researchers also found that better blogs increased student engagement, which enhanced learning results even more. This study adds to the increasing amount of data that shows blogs can be an efficient teaching tool in higher education settings. Sakip Kahraman (2021) looked into the usage of blogs as a cutting-edge assessment method to support students' development of professional skills and authentic learning. Third-year planning students participated in the study, which discovered that blogs promoted peer review, reflective practice, and enhanced learning effectiveness. Even though there was some initial pushback and worries about academic rigour, students eventually realised that blogging helped them comprehend course material and professional practices better. The study underlined how crucial peer and teacher support is to improving the usefulness of blog-based assessments. A very recent study conducted in 2024 by Mark O'Rourke and Andreanne Doyon looked at the usage of blogs as a cutting-edge evaluation tool to improve professional skill development and authentic learning. The study, which involved third-year planning students, found that blogs enhanced learning efficiency and encouraged reflective practice and peer evaluation. Although students first voiced worries about the level of academic rigour, they eventually discovered that blogging helped them get a deeper grasp of both professional practices and course material. To maximise the usefulness of blog-based evaluations, the research emphasized the significance of peer feedback and instructor support.

Research Questions

1. Can the use of blogs for writing assignments improve the English language proficiency of the learners?
2. Will the use of blogs increase the engagement of learners in academic activity in the online classroom environment?

Research Context and Participants

This study was conducted in SDNB Vaishnav College for Women, Chennai, Tamil Nadu, with 39 second-year post-graduate learners pursuing their Masters in English. As the study falls under action research, purposive sampling was employed to select the participants. The inclusion criteria applied are as follows:

(i) Students in their second year of the course

(ii) Students registered in the course of M.A English

(iii) Students who have a personal device to participate in the study

Due to the pandemic the first-year postgraduates did not get to meet their peers nor their teachers. As a Teacher, I joined at the end of the first semester and found a silent indifference in the classes due to a lack of interaction among peers and a lack of familiarity with the teacher. Due to regular internal assessments and the pressing need to finish the assigned portions, the teacher found it difficult to establish a proper working relationship with the learners. During the seminar presentations, the teacher found that the majority of the learners had difficulty articulating their ideas while presenting and in writing as well. Therefore, to help them understand their problem area in language, the teacher attempted to give specific language feedback immediately after every presentation by highlighting the grammatical errors in their sentence construction. As the majority of the learners did not trust the teacher and were not sure of the intention of the feedback, they refused to process the feedback. The agonizing longevity of the pandemic, with all its unpredictability, stifled the natural enthusiasm of the learners in learning and made them indifferent to the serious academic routine which the teacher tried maintaining, assuming it would help the learners. After a semester, the teacher found it difficult to break through the wall of indifference and silence among the learners and decided to introduce class blogging to improve the engagement level of the learners and the writing skills of the post-graduate learners.

Procedure

The learners were assigned three writing assignments for the semester. The first assignment was a self-introduction, during which they were encouraged to podcast, write or video record about themselves. The teacher gave a model self-introduction about herself as a sample. The second writing assignment was a reflective essay. They were asked to write about any one or two of their teachers (in school or college) who they considered were good teachers. A sample was provided for this as well. The rubric for the first and second assignments was simple and focused on content, language, and engagement level. The engagement was given more weightage of 10 marks, while content and language together were given 10 marks. The emphasis was on making the learners read and comment on other posts.

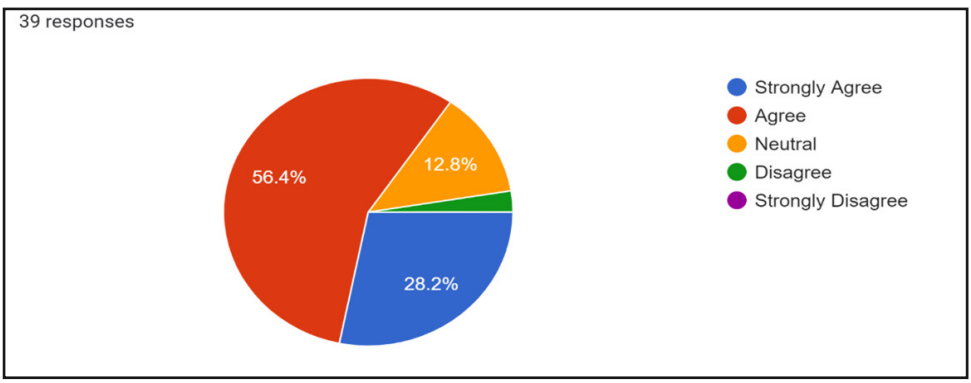
The third assignment involved topics from the "English language teaching" theory paper. Choosing their topic of interest, they were asked to write a detailed essay of 800-1000 words. Reference books and articles were given in the Google Drive of the Google Classroom, and students were also encouraged to use any standard journal articles from the internet. In case they found it difficult to find appropriate reading material for their selected topics, they were asked to inform the teacher so that she could try and help them with it. They were specifically instructed to desist from using materials from substandard online sources. However,

if they found interesting and relevant materials or videos, they were asked to provide links at the end of their blog as additional resources. It was mandated that the essay should be written in their own words without copying exactly from original sources; instead, they were encouraged to summarize the main ideas and acknowledge the source properly. They were informed that the essay should be followed by a detailed reference section where they list out all the sources, namely the books, the articles, the videos, or online articles. After providing the references, the learners were asked to give two discussion questions based on their written essays for their team members to discuss. The discussion questions should not be 'yes or No' type of questions or 'comprehension questions' but questions that would make their team members reflect and give their opinions. Each group would contain 10 members, and the discussion questions would be answered in the comment section by all the nine group members. The blog writer should respond to all the group members' responses. The same topics should be taken as seminars in the class for about a 10 to 15-minute presentation where they would explain the concept using a ppt and not read the essay. They were informed that the marks would be deducted for late submission or for not responding to comments in their own posts within the deadline provided.

Data Analysis and Discussion:

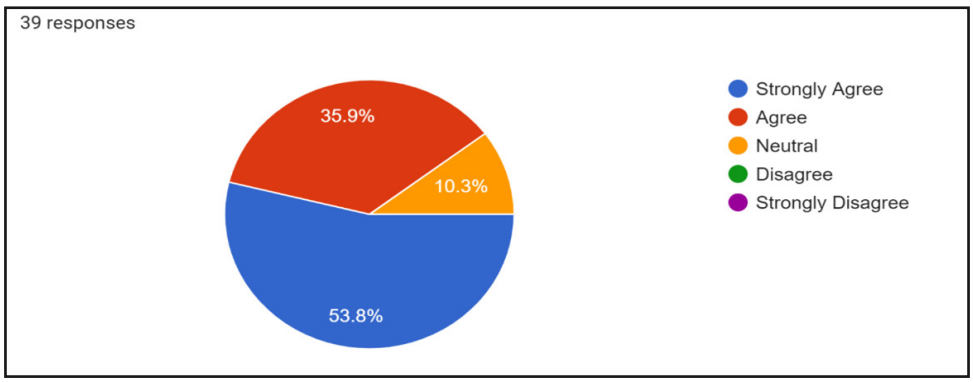
The class blog named 'Avid English Learners' (http://avidell.blogspot.com/) was created in the month of June, and on June 29 2021, the first sample post was published by the teacher. Detailed instructions regarding accepting the blog invitation to the post's drafting and publishing information were communicated through Google Classroom. The last blog post of assignment three was posted by one of the learners on October 10, 2021, and commenting on posts continued actively till November. After that, it tricked down. Therefore, the entire class was actively involved in blogging for about four months. The total number of posts that were published in the classroom blog was 125. The usage statistics from the blog revealed that the total number of comments was 2633, and the total number of views was 6792. [Appendix-1] A structured Google form survey consisting of both open-ended and closed-ended questions was administered to all 39 learners at the end of the third semester to collect their feedback. [Appendix-2] Out of the 39 learners, 86 per cent of the learners reported that they enjoyed using blogs for academic activity. 84 per cent of the learners conceded that they liked reading and commenting on others' posts.

Figure-1: I liked reading and commenting on other's posts



While 82 per cent of the learners felt that the peers' comments were motivating and encouraging, around 18 per cent replied negatively. The negative response could be attributed to the non-participation of some learners in not commenting on others' blogs. Most of the learners enjoyed the comments on their blog but they were not equally motivated to read all their peers' blog posts and comments. Many of the respondents said that even though they wanted to read everyone's blog and comment, they did not have that kind of time.

Figure-2: The comments from my peers regarding my post motivated me to a larger extent



Around 59 per cent of the learners were happy with the peer comments they received for their blog post but 41 per cent of the learners were not satisfied with the number of comments from their peers. In the following detailed analysis section the pedagogical considerations are discussed with primary focus on the qualitative open-ended questions responses gathered from the survey and based on the observation of the teacher as well.

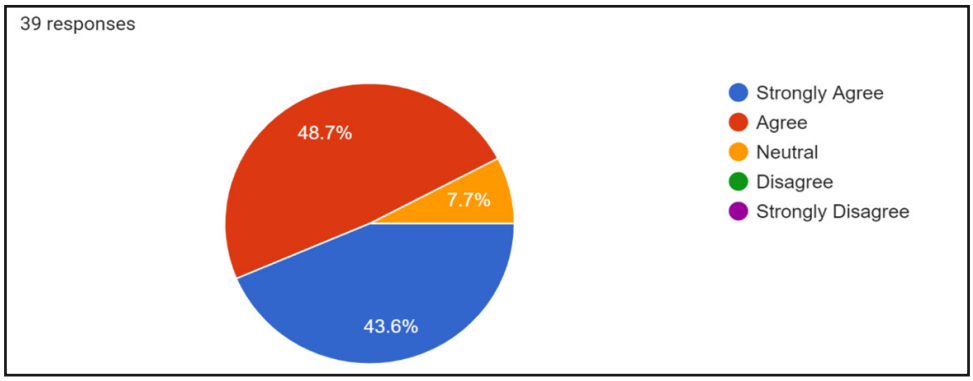
Pedagogical Considerations in blogging

In this section, the pedagogical considerations for using blogs to improve writing skills and engagement levels in each of the three writing assignments are discussed in detail.

First Writing Assignment

The behavioural and emotional engagement level was highest in the first post due to three major reasons. Firstly, many of the participants were first-time users, and since the blog was about themselves, the learners took it as an opportunity to interact and learn about their peers. They had the freedom to introduce themselves in their own way, so they were innovative to make their first post appealing. However, it should be stated that only 52 per cent of the learners said that they enjoyed writing about themselves, and another 20 per cent said that they felt neutral about it. Around 33 per cent of the learners were not happy about talking about themselves, but they complied merely to finish the academic task. The second major reason was the feedback from the teacher that they received for all their posts for the first topic. Feedback was given in two ways: written comments and WhatsApp voice notes. The written comments under each learner's blog were dialogic in response to the content, whereas the WhatsApp Voice notes were directly related to the grammatical accuracy of the content.

Figure-3: The WhatsApp feedback from my teachers helped me to improve my communication



In the previous semester the teacher had given specific language feedback to learners immediately after their seminar presentations and found that most of them were offended because of it. The teacher understood her mistake when she conducted anonymous feedback that she collected from the entire class at the end of the second semester, and therefore, the private WhatsApp voice notes were used to avoid such embarrassment for the learners. In the survey, while all 39 learners agreed that the feedback from the teacher in the comment section was motivating, 85 per cent of the learners said that they benefited from the language-related feedback given using WhatsApp voice notes. The teacher gave a model self-introduction about herself to encourage the learners to write an honest and unreserved narrative and hoped to persuade her learners as well. The post by the teacher, who was serious and stern in the second semester, was read with mixed reactions, and gradually, the learners started commenting on the teacher's post. Emboldened by the responses of the teacher to their comments, many other learners also started commenting unreservedly. There was a sense of curiosity among all the students, and they took time to read others' posts and felt comfortable commenting. Therefore, the first blog was a success as it became a platform that initiated friendships. Thirdly, the first post was given during their semester holidays as an assignment even before the semester started, and therefore, the learners had a lot of time to indulge in it all with leisure and write without any other academic commitments. Following is the reflection of Learner (Priyadharshini J) on why blogging worked for her.

> My experience of blogging was beneficial, in many ways. Importantly, I discovered myself and I came to know about the people of my age. I liked the whole process as well as the progress. From writing down my thoughts, prioritizing, organising into a format, posting it, to receiving comments and teacher's feedback about my views and language. The process and the guidance helped me think better, correct my errors and improve my skills. The feedback and comments motivated and induced confidence, indeed!

It can also be safely inferred that the cognitive engagement was also high because the discourse in the blog was within their present level of competence and was not very cognitively demanding. For some of the slow learners, reading the writing of their own peers provided appropriate cognitive challenge, which

Lev Vygotsky (1962) calls a Zone of proximal development, which is defined as the ideal challenge for a learner as the level a little beyond the easy reach of the learner but that which is achievable with appropriate scaffolds or support from an able peer or a teacher. This is also similar to i+1 concept of Stephen Krashen (1981), where he says only if the input is just above the learner's current level of competency would the learner be really involved in the learning process. The blog writing of the peers served as an engaging and appropriate input for most of the learners.

Second Writing Assignment

In the second blog activity, the behavioural engagement of all the learners remained high as all of them completed their blog posts within the deadline. There was a slight dip in the affective engagement of the learners, which could be inferred from reduced student-to-student interaction compared to the first blog. There were three reasons that could be attributed to the dip in affective engagement among the learners. Firstly, the curiosity waned as it was the second activity, and therefore, the initial burst of enthusiasm frittered away. Secondly, the third semester started bringing with it a host of other academic commitments, which made it difficult for them to concentrate wholly on the written task. Thirdly, as the semester started, the teacher too had other teaching and institutional-related commitments and, therefore, did not have the time to respond to all the posts and give individual feedback through WhatsApp voice notes.

The second post resonated with most of the learners on a personal level as it made them walk down their memory lane with nostalgia. In the second writing activity, the learners were asked to write about their favourite teachers and were asked specifically to reflect on their individual personality traits and professional expertise, which made them good teachers. In the third semester, they were doing "English language teaching" as an elective course. They were asked to elaborate on the teaching methodology and materials that the teacher employed, which made their classes interesting and informative. The writing assignment was given with the intention of making them critically examine the role of a teacher in an English Classroom and their role in the teaching and learning process of an individual learner and the entire class as a whole. Following is a feedback from Learner 26 (Rose Esther Rani)

> Well, blogging was the first assignment that really made me sit and write for pages without complaining; when there is no bar set, we get to show our creative side, and that's exactly what I liked very much about blogging. I felt quite hard to read all my fellow peer's blogs and comment on it but I would be lying if I said that's a drawback because I felt alive reading the comments posted by my peers in my post, so my point is blogging was fun I would rate my experience 9/10

Third Writing Assignment

The third post was completely academic, and the interaction dropped to the lowest. Since the topics were completely academic, most of the learners complained that it took so much time to read and even more time to understand. This time, the learners were informed that the group members should compulsorily answer the questions posted by the blogger in the comment section. Most of the students were hesitant to comment as they struggled to understand the new concepts. Learner 32 (Sheetal Mundra) shared the following disadvantage about writing the third assignment in the classroom blog:

> "... understanding concepts from each others' content was an issue. Trusting each others' research was another issue because no one knows which resource is "right", and no one likes to correct anyone over the "comments" section either. We could only rely on our teacher to correct it for us. Moreover, as a student, I cannot imagine the amount of time and energy that it takes for a teacher to patiently go through everyone's blogs and comments."

The behavioural engagement suffers when the teachers do not give very clear instructions regarding the expected outcome of an academic task and when the teacher fails to continually respond to the learners. (Skinner, E. A., & Belmont, M. J. 1993). In the third writing activity, there was confusion among the learners with regard to the veracity of the content and that certainly was revealed by the way the learners failed to meet the deadlines. The teacher, due to other teaching commitments, did not find the time to interact with the bloggers individually, which also resulted in behavioural and affective disengagement with the academic task at hand. The expected level of cognitive engagement in the third writing activity was very demanding, and therefore, the slow learners found it difficult. Even the advanced learners were unsure of their content knowledge and were very apprehensive about writing the post. The teacher realized only after giving the writing activity that she herself could have given academic articles to read and asked them to summarize or critically evaluate the research article. In that case, the anxiety with regard to the appropriacy of the content knowledge that they were all anxious about could have been avoided.

Using a blog in a large class was challenging and was not only difficult pedagogically for the teachers but also for the learners as well. It was difficult for both the teachers and the learners to read and comment individually on all 39 posts. Time and energy needed for that was more, and therefore, even if the learners were behaviourally, affectively and cognitively engaged in the blogging process, the large numbers did pose a great challenge. Around 35 per cent of the learners stated that they did not have the time to read and comment on all the posts in the Google Form survey.

Technological advantage and Issues in blogging

The choice of medium encouraged a section of the learners to dabble with images, sound files, youtube video recording, editing and screen recording. The freedom to choose the way in which they can express themself was liberating for many of the learners. Learner 35 (Sri Takshara) had this to say about the technological features of creating a blog.

> I felt blogging to be an interesting alternative to the regular class assignments. It allowed me to experience autonomous learning where there was no stress pressure or limitation being laid on me as I had the freedom to express my thoughts. Blogging has helped me express my creative side through all the fonts, backgrounds, and pictures. It also kept me motivated throughout the assignment, and the comments section acted as a platform for discussion with my classmates and teacher

Alexander McNeece (2019) posited that student engagement nurtures a growth mindset, competence, and autonomy in learners. The blogs, which had advanced technological features, allowed for creative expression and helped to engage the learners in the writing task.

The freedom of choice made them feel liberated and responsible and also promoted autonomous learning among the participants. However, it should also be recorded that another section of learners were new to digital tools and were overwhelmed with ordinary word processing itself and had difficulty in formatting their blog posts. While it was easy to type the blog post using a laptop, it was strenuous to key in using mobile devices. Moreover, many features were not accessible on mobile devices, and therefore, these challenges put off their initial interest in the writing activity itself.

Findings

The private classroom blog gave the learners an opportunity to engage in reading, analyzing, and commenting on both formal academic texts and also informal nonacademic texts such as personal narratives. Classroom Blog facilitated meaningful interaction among the learners and improved the interpersonal relationship between the learners and the teacher as well. Moreover, blogs are innately motivating to learners as the readers of the blogs are their own peers. As the learners were writing not for grades alone but for authentic audiences, the learners were all the more motivated, and as a result, the quality of their writing improved to a considerable extent. Learners took more care of their language as they were posting it online, and their peers were going to read it as well. While the majority of the learners gained knowledge of academic conventions of usage and grammar by reading the work of their peers, some felt demotivated due to their inadequacy in expressing their ideas coherently and accurately. The blog also gave the learners an opportunity to interact with digital media and be involved in the full writing process, including web searching, reviewing, drafting, revising, and editing.

Using a classroom blog to enhance students' writing abilities offers numerous benefits and implications for teachers. Blogging encourages regular writing practice, allowing students to explore various genres, which helps them develop versatile writing skills. It fosters immediate feedback through peer reviews and teacher interaction, promoting a culture of constructive critique that refines their work. Moreover, a classroom blog fosters creativity and personal expression, allowing students to develop their unique voice and increasing motivation through engaging assignments. For teachers, this approach requires adapting instructional strategies, including setting clear guidelines, providing professional development on blogging practices, and balancing structure with creative freedom. Overall, classroom blogging can significantly improve writing skills, engage students, and develop critical digital competencies, benefiting both learners and educators in the process.

Conclusion

The introduction of a classroom blog to enhance the writing skills of tertiary learners during the pandemic has yielded significant pedagogical benefits. The study revealed that blogging provides an effective platform for improving writing abilities through teacher and peer feedback while also fostering greater learner engagement. The classroom blog encouraged motivation and attention to language use by prompting students to write for real audiences rather than solely for grades. As a result, students and their teachers were able to build supportive learning communities and strengthen interpersonal relationships.

While most students gained confidence and improved their academic writing standards through this creative exercise, the study also highlights the challenges

faced by some students in expressing themselves clearly and coherently. However, by interacting with digital media, students developed important writing and digital skills. The study emphasizes the importance of offering an innovative tool that blends formal and informal elements to maximize the impact of blogging on students' learning. In conclusion, the study's results contribute to understanding how classroom blogging can improve writing abilities, encourage creativity, and equip students with digital skills. It also provides valuable insights for teachers on how to integrate technology into pedagogy in ways that meet the diverse needs of learners, boost engagement, and enhance the overall teaching-learning process.

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Appendix-1

Usage Data Retrieved from the Blog

Name	No. of comments on 1st post	No. of comments on 2nd post	No. of comments on 3rd post
L1	40	20	4
L2	38	18	6
L3	39	36	6
L4	31	19	5
L5	31	15	9
L6	36	11	8
L7	53	23	6
L8	39	16	8
L9	40	18	8
L10	23	12	4
L11	34	26	5
L12	35	13	6

Name	No. of comments on 1st post	No. of comments on 2nd post	No. of comments on 3rd post
L13	40	26	13
L14	37	14	9
L15	42	28	5
L16	42	18	6
L17	28	13	8
L18	33	16	5
L19	47	25	10
L20	17	23	6
L21	48	19	4
L22	34	17	5
L23	42	25	9
L24	47	26	8
L25	41	16	7
L26	59	32	7
L27	35	27	13
L28	28	21	8
L29	28	11	5
L30	33	19	6
L31	47	17	6
L32	46	23	6
L33	51	26	7
L34	56	32	4
L35	54	33	6
L36	43	22	4
L37	33	12	5
L38	23	13	4
L39	27	12	8

Appendix-2

Following was the Feedback collected at the end of the Study with Five Pont Likert Scale [Strongly agree, Agree, Neutral, Disagree, Strongly disagree]

Blog Review

1. I enjoyed blogging
2. I liked reading and commenting on others' posts.
3. Writing the blog helped me to write better.
4. The comments from my peers, regarding my post motivated me to a larger extent.
5. The comments from my teacher regarding my post helped me to write further.
6. The whatsapp feedback from my teacher helped me to improve my communication.
7. I was not interested in writing about my own self in a blog.
8. Blogging did not help me to improve my writing skill.
9. I did not receive as much comments as I expected.
10. I did not have time to read and comment on all of my friends blogs.
11. I did not like feedback pertaining to grammar in whatsapp.
12. What did you like about the classroom blogging? (you are expected to write a paragraph by summing up your experience as a blogger. Kindly mention your name if you are comfortable in sharing)
13. What are the things that you did not like about blogging? (feel free to write your honest reviews)

Research Article

Access and Use of DIKSHA for School Teachers and Students Amid COVID-19: An Assessment of Rural Rajasthan

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Abstract

The COVID-19 pandemic has led to unprecedented disruptions in education worldwide. With the closure of schools, the entire focus of the education system shifted to digital education. The study assessed the access and use of the online education platform DIKSHA during the pandemic in rural areas of Rajasthan. It employed mixed methods research and covered 100 government schoolteachers and 100 students of grades 9-12. The study findings indicate that 96 per cent of teachers learnt to use DIKSHA during a pandemic and used the portal for lesson plans, assessments, question banks, and improving teaching skills. 95 per cent of students used DIKSHA to access digital textbooks and interactive worksheets. Education through DIKSHA has bridged the learning gap among rural children during the pandemic. The study also assessed challenges faced by teachers and students related to internet connectivity and interruptions.

Keywords: COVID-19, DIKSHA, Online Education, Teachers, Students

Introduction

As enshrined in the Indian constitution, under Article 21-A, the fundamental right of access to education is of immense importance for a nation's overall development. Education plays a pivotal role in improving knowledge, skills, attitude, personality, and values, thus enabling a person to make informed choices to lead a dignified life. Since the launch of the Right to Education Act, India has progressed dramatically in terms of increasing enrollment rates in schools **(**Shah & Steinberg, 2019). However, completing school education is still a challenge for many children living in poor and low-income families. The Indian education system is one of the largest in the world, with more than 1.55 million schools managed by the state governments (Department of School Education & Literacy, 2021). However, ensuring equal access and quality education for all remains a major challenge, especially in bridging the education gap between the affluent and marginalized sections of society.

To promote educational equity and to bridge the education gap, the government of India has introduced several initiatives, including the latest National Education Policy 2020. The new education policy has emphasized the need to employ technology and digital platforms to improve the education ecosystem in the country at all levels. The policy recognizes the benefits and potential risks of technology and endorsed bridging the digital divide and ensuring equal access to online

and digital education for all. It calls for pilot studies, the development of digital infrastructures, online teaching platforms and tools, content creation and distribution, and the use of mass media for educational broadcasting to meet diverse learning needs and ensure widespread support.

The Indian Government imposed a lockdown in response to widespread infection with the COVID-19 virus. The pandemic adversely impacted all sectors of the country's economy, with education being the hardest hit (Gupta et al., 2020). Amid the COVID-19 pandemic, when traditional offline education channels became inaccessible due to lockdowns and social distancing, online education platforms became the primary means to deliver education to continue providing learning opportunities to school children. The crisis was a challenge but also provided an opportunity for education providers and duty-bearers to advance their technical knowledge and digital infrastructure. The Digital India Programme facilitated education in rural, remote areas through online portals, educational channels, digital learning platforms and internet availability. However, there has also been a shift towards online education as a new solution during the pandemic. This shift highlights the significance of assessing the effectiveness of online education platforms such as DIKSHA (Digital Infrastructure for Knowledge Sharing), which the Government of India introduced in 2017 to support and promote digital learning and education in the country (Sharma, 2021).

This research focused on assessing the effectiveness in access and use of DIKSHA amidst COVID-19 in rural areas of Rajasthan. It aims to explore how the DIKSHA platform helped rights holders (children) and duty bearers (teachers) ensure education continuity and bridge the education gap during the pandemic. By analyzing the policies, infrastructure, and challenges related to online education, this study aims to provide valuable insights and recommendations to strengthen the effectiveness of the scope of digital learning via DIKSHA in rural India (SWAYAM, 2022). The study also expanded the scope and opportunities for teachers and parents to use digital learning, reflect on their experiences, and further build prospects of using DIKSHA. The findings can guide interventions and investments to ensure that children and youth in rural India have equitable access to quality education during a crisis such as COVID-19.

Research Objectives and Questions

The major objective of the study is to assess access and use of DIKSHA platform among students and teachers in the government rural schools of Rajasthan amidst COVID-19 pandemic.

The major research questions of the study are:

- What is the level of access to and usage of the DIKSHA platform among schoolteachers and students in rural Rajasthan during the COVID-19 pandemic?
- What challenges do teachers and students in rural Rajasthan face in accessing and using the DIKSHA platform during the COVID-19 lockdown?

Methodology

The methodology employed for the study involves an exploratory research design, combining primary and secondary research methods with both qualitative and quantitative analysis. The sample for this study consisted of 100 teachers and 100 students of grades 9 to 12 from rural areas of the Udaipur and Jaipur districts of Rajasthan who

have used the DIKSHA online education portals during the COVID-19 lockdown.

A two-stage random sampling approach was used to determine the sample size. The villages were selected in the first stage based on random sampling procedures, followed by teachers and students in the second using the purposive sampling method. The distribution of respondents is as follows:

Table-1: Sample size

District	Teachers	Students	Total sample size
Udaipur	50	50	100
Jaipur	50	50	100
Total	100	100	200

Table 1 shows that the study was conducted in 30 villages in the Jaipur and Udaipur districts of Rajasthan and covered 40 schools, 20 schools each from the Jaipur and Udaipur districts in Rajasthan.

Literature Review

National Education Policy 2020

The Sustainable Development Goals 2030 were adopted by India in the year 2015 (Kannan, 2021). The SDG-4 reflects the global education development agenda's focus on ensuring inclusion and equal quality education for all by 2030 (Kalita & Boruah, 2020). The NEP 2020 is the 21st century's first education policy that aims to respond to the various escalating development needs of our nation (Ministry of Human Resource Development, 2022) and achieve targets under SDG 4 by 2030

The education policies introduced before NEP have mainly addressed concerns related to equity and access to education in their implementation (Maseeh, 2023). The NEP 2020 was introduced to build a new and improved education structure that is allied with the Sustainable Development Goal 4 (ensuring inclusive and equitable quality education and promoting lifelong learning opportunities for all). This gave rise to modern education which is built on Indian traditions and value systems (Pendor, 2022). In addition, this policy recommends revising all components of the education structure including its governance and regulation.

Education System amidst COVID-19 Pandemic

In response to the COVID-19 pandemic-driven lockdown in India, educational institutions were forced to shutter their physical classrooms, exams, and assessments. This abrupt shift necessitated a rapid adoption of online learning platforms as the primary mode of education delivery (Upadhyay & Khode, 2018). This transition brought about numerous challenges for both students and educators, particularly in adapting to digital teaching methods (Jadhav, Bagul, & Aswale, 2020). However, it also offered a unique opportunity for resilience and preparedness in the face of future crises. The pandemic underscored the importance of strengthening technological infrastructure in education, as highlighted by Jadhav, Bagul, and Aswale in 2020. The Digital India vision emerged as a pivotal strategy to tackle these challenges. The government at both central and state levels, as well as private institutions, played a significant role in promoting

digital learning. The Human Resource Development Department (MHRD) also took proactive steps by launching the ICT project, a consolidated platform for online learning resources (Shraim & Crompton, 2020). This collective effort aimed to ensure uninterrupted education in the midst of the pandemic.

Digital Education Schemes and Portals

Digital education and technology are rapidly becoming the future of learning in India. This approach involves using technology and digital devices to enhance education. It offers accessible learning opportunities for students worldwide, as demonstrated during the COVID-19 crisis. Digital learning tools bridge gaps in traditional classroom instruction and often prove more efficient. Studies have shown that students prefer digital platforms for quicker and more efficient access to knowledge, reducing the use of paper. Digital technology also enables cost savings, efficient resource utilization, and broadened educational reach. The Indian government supports various digital platforms and tools like Google Classroom, Zoom, GoToMeeting, and Microsoft Teams for communication and MOOCs for higher education and professional development (Lai & Widmar, 2021). Usage of modern ICT for teaching and learning in Indian higher educational institutions has become paramount. The development that information technology has brought to the field of education cannot be overemphasized. The modern perspective of E-learning is becoming more diverse as it is being influenced by many factors. Sun et al. (2008) categorized these factors into six dimensions: student, teacher, course, technology, system design, and environmental dimensions. Though user satisfaction is one of the salient factors in determining the success of a system, students are more concerned about the quality of course content in terms of E-learning systems (Adebayo, Saini, & Singh, 2021).

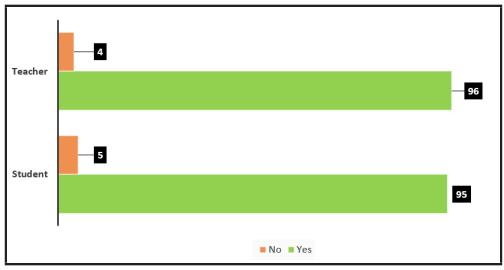
Digital Education Initiatives of the Ministry of Education

The Ministry of Education, formerly known as the Ministry of Human Resource Development (MHRD), has spearheaded numerous digital education initiatives to revolutionize learning in India. Among these initiatives are SWAYAM (Panda, et al., 2019), providing free online courses with interactive assessments; the National Digital Library, offering an extensive repository of educational resources; and DIKSHA, an integrated platform providing e-learning resources and teaching aids to teachers, students, and parents (DIKSHA, 2022). These initiatives have bridged the digital divide, expanded access to quality education, and empowered learners with diverse knowledge sources, ultimately transforming the landscape of Education in India (Kumar & Selva Ganesh, 2022).

Results

The study examined responses from rural Jaipur and Udaipur districts to evaluate the access and usage of the DIKSHA portal.

Graph-1: Awareness on Use of DIKSHA

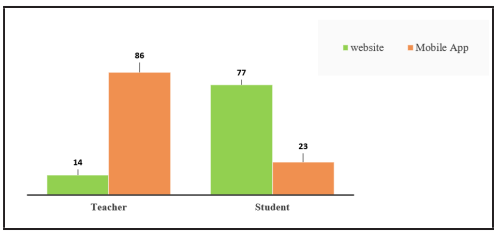


Graph 1 evealed that a significant majority of teachers (96 per cent) and students (95 per cent) in rural areas are aware of the portal. However, a small

percentage (over 4 per cent of students and 5 per cent of teachers) remain unaware of its existence and usage in education.

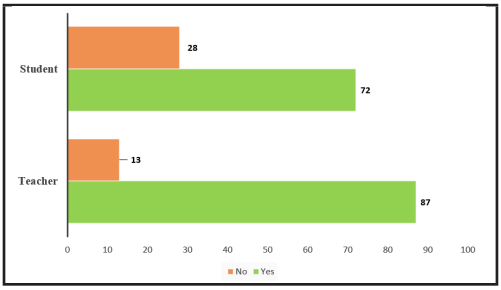
This suggests a growing awareness of digital education in India among rural teachers and students. DIKSHA is an online platform offering a wide array of courses, spanning from high school to higher education and skill sector courses. The effectiveness of the portal hinges on increasing awareness among potential users and recognizing its potential for fostering lifelong learning skills. Government circulars, orders, and teacher training on DIKSHA contributed to raising awareness, especially during the COVID-19 lockdown when online education gained significant attention nationwide.

Graph-2: Source of Access to DIKSHA



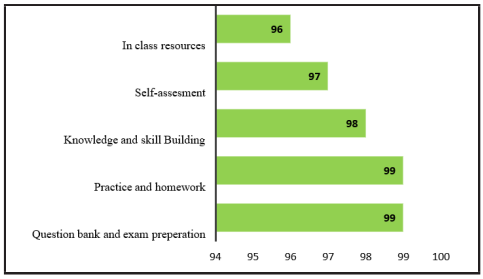
Graph no 2, depicts the responses of the study participants regarding the different sources utilized by the students and teachers to access the DIKSHA portal. The study has shown that the majority of the teachers i.e., 86 per cent, have used mobile-based apps as their source of access, and the remaining 14 per cent of the teachers shared official websites and link DIKSHA as their source of access to the portal. Among students, the primary source for accessing the portal was the official website of the online platform, accounting for 77 per cent, while 23 per cent used the mobile app. In contrast, teachers had a higher usage rate of the portal, with many using the official mobile app, which was readily available to them. The COVID-19 pandemic compelled students to switch to online platforms like DIKSHA for their education when schools and colleges were closed. This sudden shift created challenges for students who were not accustomed to these digital learning platforms.

Graph-3: Percentage of Respondents Registered on DIKSHA



As per the data indicated in Graph 3, it can be clearly observed that 72 per cent of students have registered for courses on the Central Education Ministry's DIKSHA portal, while 28 per cent have not. This increasing student registration suggests a growing interest in online education in India. In comparison, teacher registration on the portal shows a slightly higher trend, with 87 per cent of teachers indicating they have registered for courses. This implies that teachers have actively engaged with the portal, likely using it for course creation and delivery. However, 13 per cent of rural teachers in the study have yet to register. The rising trend in registration among both teachers and students in rural areas signifies increased access to curriculum-aligned content on the platform. As registered users of DIKSHA, these individuals have greater access to varied educational materials, contributing to the education of marginalized children and enhancing their learning outcomes through digital initiatives.

Graph-4: Reasons for Using the Portal



The data in the graph 4 suggests that the most common reasons for using these portals are self-assessment with 97 per cent of students, Question Bank and Exam Preparations by 99 per cent of students, Practice and Homework by 99 per cent of students, and teacher lesson planning rather than direct student engagement in the learning process. Moreover, teacher-developed resources on DIKSHA have been highly effective, benefiting 96 per cent of students in their lesson learning. Overall, DIKSHA has proven to be a valuable tool, providing quality educational resources and aiding the academic progress of rural students. Knowledge and Skill Building with 98 per cent of students, respectively. These findings underscore the platform's significant impact in enhancing academic performance and preventing dropouts during school closures.

Chart-1: Teaching Learning Material Used by Students

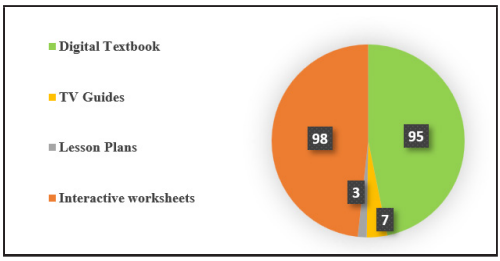
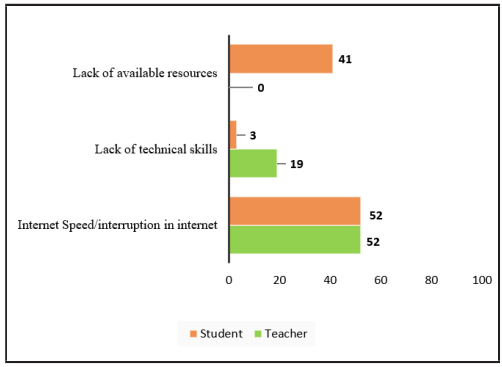


Chart 1 reveals that digital textbooks and interactive worksheets are the most favored learning materials among students, with 95 per cent and 98 per cent utilization rates, respectively. Digital textbooks are appreciated for their convenience, accessibility, and cost-effectiveness, providing a wide array of educational resources. Interactive worksheets, on the other hand, enhance engagement and active learning. In contrast, TV guides are utilized by only 7 per cent of respondents, potentially due to limited TV programming access or alternative preferences, while lesson plans find use among a mere 3 per cent of students, indicating their primary role in teacher lesson planning rather than direct student engagement in the learning process.

Graph-5: Major challenges being faced by teachers and students



Graph 5 illustrates the challenges encountered by teachers and students when using online portals like SWAYAM/ DIKSHA in rural areas. The primary challenge, faced by 52 per cent of both teachers and students, is Internet speed and interruptions, mainly due to inadequate internet infrastructure in rural areas. Additionally, many students lack access to digital devices, exacerbating the digital divide, particularly evident during the pandemic. The second challenge, lack of technical skills, is reported by 19 per cent of teachers and only 3 per cent of students, suggesting a need for teacher training and support. The third challenge, lack of available resources, affects 41 per cent of students but none of the teachers and is related to the scarcity of devices like computers or smartphones in rural areas. Addressing

these challenges is crucial for making online education accessible in rural regions, requiring improvements in infrastructure, connectivity, training, and resource provision. While online education platforms like DIKSHA and SWAYAM have shown positive outcomes during the pandemic, efforts to promote digital education and raise awareness in rural areas must continue, considering the challenges faced by some teachers and students.

Discussion

Overall, the study assessed the access and use of an online education platform, DIKSHA, in the context of rural areas amid the COVID-19 pandemic, and it emerged from the study very strongly that the use of DIKSHA played a crucial role in ensuring education and continued learning for teachers and students in rural areas of the country. The education department provided detailed guidelines and facilitated the use of DIKSHA during COVID-19, generating widespread awareness among students and teachers. However, some teachers and students are still unaware of these platforms, highlighting the need for continued efforts to promote digital education and raise awareness in rural areas. The study also shows that most teachers and students have faced challenges in using online portals, with internet speed/interruption in the internet being the primary challenge. Other challenges include limited technical skills and available resources such as digital devices. These challenges underline the need for improvements in digital infrastructure, connectivity, and training to ensure that online education platforms can provide maximum benefit to students and teachers in rural areas.

Conclusion

The constitution of India has given fundamental rights to education, which is guaranteed under Article 21-A. In India, education has a crucial role in the expansion and development of the entire society, particularly in the ramifications for the economic, social, and technological underpinnings of society. The Indian Government has launched a number of initiatives, including DIKSHA as digital infrastructure, to reduce the gap in education and bring educational parity. The NEP 2020 strongly emphasizes the value of enhancing education via the use of technology and digital platforms. In reaction to widespread COVID-19 infection, the Indian government instituted a lockdown. The pandemic adversely affected all areas of the country's economy, but the education sector was the hardest devastated. This study examined the effectiveness and use of DIKSHA during COVID-19 in rural areas. The study broadened the range of options for educators and students to use digital learning, think back on their knowledge, and further develop DIKSHA usage prospects in the country's marginalized areas.

The findings of the study provided valuable insights into DIKSHA usage patterns and preferences of teachers and students in rural areas regarding online education portals. The data indicates that teachers exhibit higher engagement with the DIKSHA portal, utilizing it for various purposes such as course registration, resource creation, and peer collaboration. This study highlighted the effectiveness of platforms like DIKSHA in supporting teacher professional development and enhancing classroom instruction. For students, the online portals have proven to be instrumental in accessing assessment aids, question banks, exam preparation materials, and in-class resources, which substantially contributed to their academic performance and knowledge acquisition. The DIKSHA platform has

bridged the learning gap through a broader educational landscape available online during the COVID-19 pandemic. However, the study also identifies challenges faced by teachers and students, particularly related to internet connectivity and interruptions. These obstacles need to be addressed to ensure equitable access to online education in rural areas.

Recommendations

Improving Internet Infrastructure: To strengthen the digital learning environment for children in rural areas, collaborative efforts are required among educational institutions, government agencies, telecommunication companies and civil society organizations. Investments in digital education infrastructure need to be enhanced, such as expanding network coverage and improving bandwidth, to reduce internet-related challenges and ensure accessibility of learning facilities to all at all times.

Digital Literacy Training: Comprehensive training and capacity-building programs should be designed and implemented to enhance the digital literacy skills of both teachers and students. These programs should focus on familiarizing them with online portals, optimizing their usage, and effectively integrating digital resources into the teaching and learning process.

Continuous Evaluation and Improvement: Regular monitoring and evaluation of utilization of the DIKSHA portal should be conducted regularly by including feedback from users, particularly teachers and students. This should be actively sought and considered for making necessary updates and improvements to the portal for education purposes.

Partnerships and Collaboration: Strengthening partnerships between educational institutions, government bodies, and ed-tech companies can promote developing and delivering high-quality online education resources/ services. Collaborative efforts can help in leveraging expertise, sharing best practices, and ensuring that online portals cater to the specific needs of rural areas.

Awareness Campaigns: Launching awareness campaigns at the grassroots level is crucial to inform teachers, students, and parents about the benefits of online education portals. These campaigns should highlight the potential of these platforms in improving learning outcomes and guide how to access and utilize them effectively.

By implementing the recommendations based on the study, the existing challenges can be addressed, and this will further unlock the full potential of online education platforms in rural areas during the crisis and school closures. Empowering teachers and students with reliable connectivity, digital literacy skills, and access to high-quality resources will contribute to an inclusive and equitable education system.

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Research Article

Effectiveness of Concept Mapping and Branching Programming Learning Material on Achievement in Economics

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Abstract

The title of the research was "Effectiveness of Concept Mapping and Branching Programming Learning Material on Achievement in Economics". The objectives of the study were (i) To compare the mean ranks of gain scores of the Traditional lecture group and Concept Mapping group and (ii) To compare the mean ranks of gain scores of the Traditional lecture group and the Branching Programming Learning Material group. (iii) To compare the mean rank of gain scores for the Concept Mapping group and Branching Programming Learning Material group. A purposive sampling technique was used by the researcher in which the sample size was 67, from which 25 students were from experimental group 1 (Concept Mapping group), 25 students were from experimental group 2 (Branching Programming Learning Material group), and 17 students were from the Traditional lecture group, for data collection self-made Achievement test was used. The non-equivalent control group design was used for this study, and data was collected from two schools in Indore. The treatment was given to experimental groups for 9 days, including administration of pre and post-tests. The Mann-Whitney U test was used to analyze the objectives. The findings of the research were that (i) The mean ranks of the Concept Mapping group were significantly higher than those of the traditional lecture group, (ii) The mean ranks of the Branching Programming Learning Material group were significantly higher than those of the traditional lecture group, (iii) The mean ranks of Branching Programming Learning Material group was significantly higher than Concept Mapping group.

Keywords: Achievement in Economics, Branching Programming Learning Material, Concept Mapping

Introduction

Learning is a purposeful, conscious and complex process. An important feature of learning is that it involves a complex interactive system that includes environmental, social, motivational, emotional, and cognitive factors (Cheema & Mirza, 2013). In the traditional learning process, the teacher transmits the facts and assumes students as passive receptors of knowledge. This passive learning prevents the students from constructing their knowledge and understanding the concepts to apply them in their day-to-day lives. Nowadays, various teaching-learning strategies have been developed to accelerate students' learning process. The curriculum demands teaching-learning strategies that may involve students in their own knowledge construction, placing them as the centre of learning activity and

the teacher as a facilitator. This strategy involved Mind mapping, Topic mapping, Concept mapping, programmed learning, etc. Concept mapping is one of the teaching-learning strategies under constructivism having its orientation in David Ausubel's Assimilation theory 1968 of cognitive learning which aims at fostering meaningful learning by students. Concept map is a tool that is used to illicit students' knowledge and helps the learner in learning of concepts.

Concept Mapping

The techniques of Concept mapping were developed by Joseph Novak of Cornell University in the 1970s as a means of demonstrating the developing science knowledge of students. Concept maps have been used as a tool to upturn important learning in Science and other subjects as well as to characterize the expert knowledge of individuals in education. Concepts are defined as abstract ideas. It is a generally accepted and understoo d collection of meaning and characteristics associated with certain events, objects, conditions, situations, people or behaviour. Concepts are denoted by names, symbols or signs of our language. A concept Map or conceptual diagram is a diagram that describes suggested connections between concepts. It typically denotes ideas and information as boxes or circles, which it links with labelled arrows, often in a downward branching hierarchical structure but also in free-form maps. According to Novak and Gowin (2010), "Concept maps are constructed to represent visually meaningful relationships among concepts in the form of propositions".

Branching Programming Learning Material (BPLM)

Norman A. Crowder, an American psychologist, is credited for developing Branching Programming Learning. Branched or intrinsic programming is one which adapts to the needs of the learner. In this type, each frame is of a relatively bigger size and may contain two or three ideas related to the sequence. A single question, usually of the multiple-choice type, is asked at the end. The learner selects the response. If the learner chooses correctly, he is taken to the next frame in the main teaching sequence. If his response is wrong, he is diverted (Branched) to a remedial frame where his mistake is explained, and the topic under consideration is further explained, perhaps using some more examples. After remedial work, he is directed to the original frame to make another attempt at choosing the right answer. The learner moves forward if he answers correctly but is diverted (Branched) to one or more remedial frames if he does not. This cycle goes on till the learner passes through the whole instructional material.

Rationale

Traditional methods or strategies of teaching are teacher-centred. Piaget and Kohlberg are the constructivists who gave more focus on active learning, keeping the child in the centre. Different methods and techniques are used by the teachers to keep the student active and engaged in the classroom by keeping in mind the interests and needs of the individual learner. Economics is a social science, which means it studies society and the relationship between them. Economics is a part of Social Science till class 8, but some parts of Economics may be taught from class 6, including civics. Till class fifth, students already learn something about social science in EVS, but Economics is a new and complex subject for class 6 to 8 students. Economics sometimes deals with some statistical data and technical words, which is sometimes very difficult for students to understand the basic concept, so teachers try to use different

methods for teaching Economics, such as Concept Maps, Project methods, Play-Way methods, Programmed Learning Material, etc.

Few studies on the use of Programming Instruction have been found in India like:

Shah (1968) developed programme material in mathematics on solving equations for class VI students and conducted an experiment for using it. It was found that the group taught by the program alone did significantly better than the traditional lecture method group. Joshi (1972) Developed programmed learning material for first-year degree students in Maharashtra. It was found that learning with programmed learning material was more effective, permanent, and interesting than the traditional method. Chopra (1995) developed the programmed learning material in Home Science on food and nutrition for twelfth-grade students and found it effective for learning. Shihabudeen (2001) found that the group that learnt English through programmed instruction achieved higher mean scores than that of the control group, which learnt through the conventional method of teaching. Ujjainwala (2012) conducted a study to know the effectiveness of computerized branched programme learning material in achievement in chemistry subjects and found that the use of branched programme learning material improved the achievement of students in chemistry. Jain (2017) found that programmed instruction is effective in terms of achievement in English. Sambasivarao (2020) conducted a study on the impact of Programmed Instruction on academic achievement in mathematics. The study found that the use of a programmed instruction strategy improved achievement in mathematics learning.

Novak (1983) found concept mapping is effective for junior high school science students. Pankratius (1990) found that achievement in the Physics of concept mapping group was significantly higher than that of groups that received standard instructions. Ragwalan (1991) studied concept mapping in learning Physical Science and found that the experimental and control groups of boys, girls and Co-educational students had no difference in post-test scholastic performance. Regis and Giorgio (1996) proposed the application of concept maps in Chemistry teaching in high schools. Williams (1998) used concept maps to assess conceptual knowledge and found it effective in terms of mathematical achievement. Gupta (1999) found that the concept mapping model is significantly more effective than the conventional method to foster concept learning in terms of comprehension and application of concepts in chemistry. Ahuja (2007) studied the effectiveness of concept mapping in Science and found positive results. Shailaja (2008) found concept mapping is effective in the achievement of Physics. Dammani (2011) found that the concept mapping strategy was significantly more effective than the concept attainment model in terms of understanding English grammar concepts. Amita (2015) found that the achievement in Biology of class IX students in the concept mapping group was significantly higher than that of the traditional group. Kumuda (2016) developed the concept maps for higher secondary school students in physics and found that the gain scores of students taught through concept mapping are significantly higher than the gain scores of students taught through the lecture method. Anamika (2016) developed the concept maps for IX students in Chemistry and found that concept mapping has a positive effect on cognitive skills and enriches the concept attainment. Besty (2019) found that achievement in Chemistry of higher secondary

students is significantly improved by concept mapping as compared to activity oriented method. Chauhan (2020) found that the understanding in various concepts of Social Science is significantly higher by concept mapping as compared to conventional methods. Jena (2020) found a significant difference in science achievement between the Spider Map Concept Approach and the Hierarchal Concept Map Approach over the Traditional Approach of Teaching. Pandey (2020) found that Concept Mapping is more effective than traditional teaching of Biology. Nausheen (2021) found Concept Mapping is effective in terms of Science achievement.

It is clear from above previous research works that most of the research works have been done regarding concept mapping and Science subject, but no one has done this study in Economics. Thus, in this study researcher wants to study the effect of Concept Map and BPLM on achievement of students in Economics of class VII students.

Statement of Problem

"Effectiveness of concept mapping and branching programming learning material on achievement in economics"

Operational definition of key terms

- **Concept Mapping**: It is a strategy or technique of teaching any topic or concept by dividing the one concept or topic in various different sub- concepts or sub- topics by establishing link or relationship between them.
- **Achievement**: This refers to the marks scored by students in the Economics test related to chapter 7, 'Market Around Us'.
- **BPLM:** It is an MS Office PowerPoint based self-learning material where content is arranged in a logical sequence. In which each slide consists of content after which a question will be asked, on choosing the correct option the learner will move forward to read the next content, if the answer is wrong then the learner will be given remedy and has to re-read that slide.

Objectives

1. To compare the mean ranks of gain scores of the Traditional lecture group and Concept Mapping group.
2. To compare the mean ranks of gain scores of the Traditional lecture group and Branching Programming Learning Material group.
3. To compare the mean ranks of gain scores of the Concept Mapping group and Branching Programming Learning Material group.

Hypothesis

1. There is no significant difference between the mean ranks of gain scores of the Traditional lecture group and the Concept Mapping group.
2. There is no significant difference between the mean ranks of gain scores of the Traditional lecture group and the Branching Programming Learning Material group.
3. There is no significant difference between the mean ranks of gain scores of the Concept Mapping group and the Branching Programming Learning Material group.

Delimitations

- The study was delimited to only English medium students.

- The Concept Maps and BPLM were developed in Chapter 7, "Market Around Us", of Economics only.
- The study was delimited to Schools affiliated with only the MP Board.

Methodology

The experimental method was used for this research in which the independent variable was teaching strategy, and the dependent variable was an achievement in Economics.

Sample

The present study was conducted in two schools in Indore city. The population comprises all students of class 7th in the session 2022- 2023 in Indore MP Board School. A purposive sampling technique was used to select the schools. The selected schools were Namdev Panjwani Higher Secondary School and Jagdale Higher Secondary School. The selected schools were assigned randomly to two levels of treatment. Namdev Panjwani Higher Secondary School formed the Experimental groups and taught with Concept Mapping and Branching Programming Learning Material, while Jagdale Higher Secondary School formed the Traditional lecture group and taught with traditional strategy. The sample consists of 67 students, out of which 25 students were from Experimental Group 1(Concept mapping group), 25 students were from Experimental Group 2 (Branching Programming Learning Material group), and 17 students were from the Traditional lecture group. The age range was to be 12 to 14 years. The medium of instruction in both schools was English, and both schools belonged to the urban area of the Indore district. The students were from different socio-economic statuses.

Table-1: Group-wise and gender-wise sample

School Name	Group	Gender	Sample
Namdev Panjwani Higher Secondary School	Experimental group 1 (Concept Mapping)	Male	9
		Female	16
	Experimental group 2 (BPLM)	Male	25
Jagdale Higher Secondary School	Traditional lecture group	Male	6
		Female	11
		Total	**67**

Tool: Achievement Test

The achievement test consisted of 20 multiple choice questions related to chapter 7 "Market Around us" of Economics which have 4 alternatives and out of 4 alternatives, one alternative was correct. For one correct answer one mark was given and zero mark was given for a wrong answer. The test was of 30 minutes duration and of 20 marks. The general information was filled by the students such as Name, Class, Gender and School name.

Experimental Design

In the present study non-equivalent control group design was used. Firstly the pre-test was administered on both the traditional and experimental groups and then treatment was given to only experimental groups after that post-test was administered on both the groups. The layout of designs is as follows-

Traditional lecture group	O_1		O_2
Experimental Group 1	O_1	X_1	O_2
Experimental Group 2	O_1	X_2	O_2
Where O_1 stands for pre-test			
O_2 stands for post-test			
X_1 Stands for Concept Mapping			
X_2 stands for Branching Programming Learning Material			
..... Non-equivalency			

Development of Concept Map and Branching Programming Learning Material

To make the concept map, the researcher searched for the different apps through which concept maps can be made very easily and in an interesting manner, along with different images, colours and backgrounds. Thus, the researcher found different apps such as Design Hill, canvas, Get Mind, Nova Mind, Map Tool, etc. The researcher chose the map tool to design a concept map as this tool contains many features like inserting images, colours, background images, and adding different links. Multiple links can be added to each concept to form a dynamic map that opens web pages or local documents.

The Branching Programming Learning Material was developed through the Microsoft PowerPoint application. For creating the presentation, a slide with all the instructions regarding the program was mentioned, and then the homepage was made where the content was displayed. For this, the content analysis was done by dividing the content into major parts. The content was explained in simple language, and for every difficult word, the meaning was provided with the help of a hyperlink so that on hovering over the difficult word, the meaning of the word would appear. For a better understanding of the content, images, graphs and tables were also used. After each content, multiple choice questions related to the content were asked. On choosing the right answer, reinforcement was given with the help of GIFs or images, and for wrong answers, a remedy was given.

Data Collection

First, permission was obtained from the principals of all schools. A good rapport was established between the students. Then pre- test was taken of both the experimental and traditional group on the first day. Then the treatment was given to experimental group for consecutive 7 days. Meanwhile, the traditional group was taught the same topics with traditional method. After giving treatment for 7 days, a post-test was taken from the experimental and traditional groups on the last day.

Data Analysis

In the research study, there are three groups: Concept Mapping, Branching Programming Learning Material group, and Traditional lecture group and group. The sample size was 25, 25, and 17, respectively. In fewer samples, there is a strong chance that any or all assumptions of normality, homogeneity, and outliers will likely be violated. Due to the purposive sampling technique and smaller sample size, Mann Whitney U test was used, and it is also equally powerful, as evidenced by the significant result of the study.

Comparison of mean ranks of gain scores of Traditional lecture group and Concept Mapping Group

The first objective of the research was "To compare the mean ranks of gain scores of traditional lecture group and Concept Mapping group". For analyzing the data Mann-Whitney U test was used, and the results for the treatment effect on achievement were as follows:

Table-2: Summary of Mann-Whitney U test for comparing the mean ranks of gain scores of traditional and concept mapping group

DV	Treatment	N	Mean ranks	Sum of ranks	Mann – Whitney U	Z	P
Ach.	Lecture	17	15.35	261.00	108.00	-2.69	.007*
	Concept Mapping	25	25.68	642.00			

**Significant at 0.01 level*

From the above table, it is clear that the value of Mann-Whitney U for the treatment is 108.00, and the Z value is - 2.69, for which the value of two-tailed significance is 0.007, which is less than 0.01 level of significance. Therefore, the U value is significant at a 0.01 level of significance. In this view, the null hypothesis, "There is no significant difference between the mean ranks of gain scores of traditional lecture group and Concept Mapping group" is rejected. This means that there is a significant difference between the mean rank of gain scores of the traditional lecture group and the concept mapping group.

From the above table, it is also clear that the value of mean rank of Concept Mapping group is 25.68 which is higher than traditional lecture group which is 15.35.Therefore, it is concluded that the treatment of Concept Mapping is found to be significantly higher to the traditional method for teaching Economics.

Comparison of mean ranks of gain scores of Traditional lecture group and Branching Programming Learning Material Group

The second objective of the research was "To compare the mean ranks of gain scores of traditional lecture group and Branching Programming Learning Material group. For analyzing the data, Mann Whitney U test was used, and the results for the treatment effect on achievement were as follows:

Table-3: Summary of Mann-Whitney U test for comparing the mean ranks of gain scores of the Traditional group and Branching Programming Learning Material group

DV	Treatment	N	Mean ranks	Sum of ranks	Mann – Whitney U	Z	P
Ach.	Lecture	17	11.21	190.5	37.5	-4.5	.000*
	BPLM	25	28.5	712.5			

**Significant at 0.01 level*

From the above table, it is clear that the value of Mann-Whitney U for the treatment is 37.5 and the Z value is –4.5, for which the value of two-tailed significance is 0.000, which is less than 0.01 level of significance. Therefore, the U value is significant at a 0.01 level of significance. In this view, the null hypothesis, "There is no significant difference between the mean ranks of gain scores of the traditional group and Branching Programming Learning Material group", is rejected. This means that there is a significant difference between the mean rank of Gain scores of the traditional group and the branching programming learning material group.

From the above table, it is also clear that the value of mean rank of Branching Programming Learning Material group is 28.5 which are higher than traditional group which is 11.21. Therefore, it is concluded that the treatment of Branching Programming Learning Material is found to be significantly higher to the traditional lecture method for teaching Economics.

Comparison of mean ranks of gain scores of Concept Mapping group and Branching Programming Learning Material Group

The third objective of the research was "To compare the mean ranks of Gain scores of Concept Mapping group and Branching Programming Learning Material group". For analyzing the data, Mann Whitney U test was used, and the results for the treatment effect on achievement were as follows:

Table-4: Summary of Mann-Whitney U test for comparing the mean ranks of gain scores of Concept Mapping group and branching programming learning material group

DV	Treatment	N	Mean ranks	Sum of ranks	Mann - Whitney U	Z	P
Ach	Concept mapping	25	20.86	521.50	196.50	-2.26	.024 *
	BPLM	25	30.14	753.50			

**Significant at 0.05 level*

From the above table, it is clear that the value of Mann-Whitney U for the treatment is 196.50, and the Z value is is-2.26, for which the value of two-tailed significance is 0.024, which is less than 0.05 level of significance. Therefore, the U value is significant at a 0.05 level of significance. In this view, the null hypothesis, "there is no significant difference between the mean ranks of gain scores of Concept Mapping group and Branching Programming Learning Material group", is rejected. This means that there is a significant difference between the mean rank of Gain scores for the Concept Mapping group and the Branching Programming Learning Material group.

From the above table, it is also clear that the value of mean rank of Branching Programming Learning Material group is 30.14 which are higher than Concept Mapping group which is 20.86. Therefore, it is concluded that the treatment of Branching Programming Learning Material is found to be significantly higher to the Concept Mapping for teaching Economics.

Findings

1. Concept Mapping is more effective as compared to the traditional lecture methods in terms of the achievement of students.

2. Branching Programming Learning Material is more effective as compared to traditional lecture method in terms of achievement of students.
3. Branching Programming Learning Material is more effective as compared to Concept Mapping in terms of achievement of students.

Discussion

Novak (1983), Pankratius (1990), and Shailaja (2008) demonstrated its success in improving science and Physics performance. Similarly, Regis and Giorgio (1996) and Gupta (1999) confirmed its efficacy in Chemistry, while Williams (1998) found it beneficial for Mathematics. Ahuja (2007) and Dammani (2011) supported the method's positive impact on science and English grammar learning, respectively. Studies by Amita (2015), Kumuda (2016), and Besty (2019) reaffirmed that concept mapping led to significantly higher achievement in Biology, Physics, and Chemistry when compared to traditional methods. Research by Chauhan (2020), Jena (2020), and Pandey (2020) further emphasized its superiority over conventional teaching approaches in Social Science and Science. Overall, the findings show that concept mapping not only enhances comprehension but also fosters deeper understanding, making it more effective than traditional methods in improving student achievement across disciplines. Shah (1968) and Joshi (1972) demonstrated that students taught using programmed instruction in mathematics and at the degree level outperformed those taught through traditional methods. Similarly, Chopra (1995) found programmed instruction in Home Science to be more effective for learning. Shihabudeen (2001) and Jain (2017) confirmed the method's success in English, while Ujjainwala (2012) and Sambasivarao (2020) found that computerized and branched programmed learning significantly improved student achievement in Chemistry and Mathematics, respectively. The cumulative findings strongly suggest that programmed instruction, particularly branching programming, offers individualized learning that enhances comprehension, retention, and engagement. Therefore, applying branching programmed learning material in teaching Economics is expected to result in better student achievement compared to traditional methods, as it allows students to learn at their own pace and grasp complex ideas more effectively.

Conclusion

The discussion shows that both concept mapping and programmed instruction are more effective than traditional teaching methods across various subjects. Concept mapping improves student achievement in Science, Mathematics, Chemistry, Social Science, and English by enhancing comprehension and fostering deeper understanding. Similarly, programmed instruction, especially branching programming, proves superior in improving student performance in subjects like Mathematics, English, Home Science, and Chemistry by offering individualized, self-paced learning. In conclusion, both methods significantly enhance student achievement, making them valuable alternatives to conventional teaching strategies. Their application in subjects like Economics is likely to yield similar positive outcomes.

Implications

The findings have implications for the teachers, students, parents and content developers, which are as follows:-

Teachers- Concept mapping strategy proved to be very useful for teachers

as they can make their teaching very effective by using concept maps in teaching various concepts of economics. Further, the teachers also use Branching Programming Learning Material to divide the whole content into small chunks and give a chance to students to learn at their own pace. Also, the teachers are being exposed to the concept map; there is a need to stress that the content given in the syllabus should be analyzed in sequences, and appropriate concepts should be identified by teachers so as to make their teaching effective.

Students- Concept maps and Branching Programming Learning Material is very useful for students to make their learning very effective. The student should understand each and every concept thoroughly which will help in meaningful learning and which in turn enhance their achievement also students can make their own concept maps on their own understanding which will help them to remember the concept for a lifetime.

Parents- Concept maps and Branching Programming Learning Material are equal important for parents as it will help them to teach their child at home and helps their child in doing the revision of the ideas during their exams.

Content developers- Concept maps and Branching Programming Learning Materials serve as tools for content developers. Building and using a concept map representing the entire study programme is beneficial for different stakeholders involved in the content development. Concept map and BPLM is a guide for the sequencing of topics throughout the curriculum. The use of concept maps and BPLM allows identifying missing linkages, inconsistencies, false assumptions and previously unrecognized relationships.

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Research Article

Qualitative Investigation into the Mental Health Effects of Social Media among Educated Individuals

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Abstract

In today's digital era, social media has become an integral part of daily life, offering both opportunities and challenges for mental health. While it fosters social connections and provides platforms for sharing experiences, it also exposes users to risks like cyberbullying, information overload, and unhealthy comparisons. This qualitative study explores the nuanced relationship between social media usage and mental health within the educated Bengali community, focusing on individuals who engage with social media regularly and have experienced its negative effects. Using purposive sampling, seven participants aged 35 to 45 were selected, each with a minimum of two hours of daily social media usage and prior negative exposure. A focus group discussion was conducted, and the data was thematically analyzed to uncover both positive and negative perceptions of social media's impact on mental health. Key findings reveal the dual nature of social media, highlighting its role in emotional support and mental health awareness, as well as concerns related to low self-esteem, cyberbullying, and social media addiction. The study emphasizes the need for digital literacy, early intervention, and responsible content creation as strategies to mitigate these risks.

Keywords: Social Media, Mental Health, Educated Users' Perspectives, Qualitative Analysis

Introduction

A fundamental aspect of almost everybody's lives in the 21st century is the technological advancement of media (Nesi, 2020). A showground within the world of electronic media consists of internet services on telecommunication devices such as phones, instant messaging applications, interactive multiplayer video games, virtual reality sites, social networks, emails, and the list is endless. The young generation of the new millennium is the first to grow up with what is considered technology. People are immersed in a world of social media. This generation is "always connected" when they enter the critical mental and physical growth developmental stages. They have constant exposure and interaction with cell phones, computers and the internet (Vaingankar et al., 2022).

One very crucial and prominently most important feature that technology accompanies is that the millennial now finds it very easy to remain attached to friends, family, and acquaintances, thereby creating a large social network and sphere of influence. They are used to staying in touch with relatives on a more regular basis and find that they need constant social interaction when going about everyday activities (Khalaf et al., 2023).

It is proposed that the alluring prospects of advanced technology constitute what is termed a relatively safe place to have social interaction without requiring the social skills demanded in in-person interaction (Zsila & Meyes, 2023). The environment of social media might provide a comfortable setting for an introverted or shy child to interact with peers. It is believed to contribute a stage for everybody to remain connected to relatives, with updates about the events in their lives. On the contrary, critics argue that one concerning aspect of growing up in this century is the desensitization to aspects that were formerly understood as taboo (Daneback et al., 2018). With the increased participation in this shared virtual social space and the open web available as an instant tool, many have been subjected to a myriad of content that some would deem not inappropriate, such as pictures and videos of violence, pornographic material, language and conversation that includes lewd or obscene content, notorious social issues and more (Nicklin et al., 2020). Controversy has it that there are psychological and societal repercussions that might be consequent from repeated and regular participation in social media.

Advanced equipment is a hiding room for the destructive and often lethal bully- cyberspace (Kaloeti et al., 2021). It is the utilization of the internet or other digital devices such as emails, messaging, texts, networking websites, web pages, blogs, chat rooms or interactive game sites to send negative and harmful messages and images. Social media presents a virtual, unreachable world in which others may find an easy platform for cyber bullying, particularly sex badgering (Finkelhor et al., 2022). Cyber-bullying is relational aggression intended to make the victim feel frightened, humiliated, helpless, and too often hopeless (Giumetti et al., 2022). It can be anonymously done. Perpetrators can torture and harass without detection. It can be conducted 24/7, and it constantly appears on the phone and computer that a young person uses on a daily basis. It assaults privacy boundaries in a way that magnifies horror as it makes damaging materials public to an infinite audience who can instantly download, save or forward them to others.

Statistics reveal every 25 per cent of students from 6th grade and above have been exposed to virtual bullying in the United States (Peebles. E, 2014). NCRB data accounts state that cybercrimes in India increased by 63.48 per cent from 2018 to 2019, which saw an expansion of 12.32 per cent in 2020 (Kaur et al., 2023). Perpetrators usually engage in social sabotage of others. Girls are twice as likely victims than boys. On the other hand, boys are further expected to target girls and less aggressive males. Sexual and homophobic harassment is emerging as a prevalent aspect of cyberbullying (Elipe et al., 2017). Cyberbullying is most prevalent among 15 and 16-year-olds, and the more that young people share their identities and thoughts on social networking sites such as MySpace and Facebook, the more likely they are to be targeted than those who do not use the sites.

One of the consequences of virtual sexual harassment is the dismissal by many young adults that it's not a valid form of harassment (Biber et al, 2002). While the scope of sexual harassment has changed greatly with the popularity of social media, education among teens has not. Often, the traditional teachings and warnings of previous generation are the standards by which children now-a-days gauge the seriousness of the situation (Bozzola et al, 2022). If they haven't been touched inappropriately or lived in person, they may not recognize the violation as harassment. Also, many cases remain under-reported as with

reporting, one may face the public embarrassment and humiliation that might ensue with online sexual bullying (Aitchison et al., 2021).

What was formerly taken as confidential and delicate has now become public for all eyes to see. Even though there are numerous aspects to sexual relationships that go beyond virtual flirting and visual objectification of bodies, assumptions have it that young people of this age are becoming indifferent to the knowledge and are indulgent in things that are not meant to blast out to the public. However, extremely private affairs are published on various social media platforms or pornographic websites as a form of revenge porn (Walker et al., 2017). Also, it is not yet fully understood whether online discussions and contents of a sexual nature are desensitizing personal, emotional and physical implications of sex in the young generation, leading to sexual dysfunction in extreme cases (Park et al., 2016).

Youthful communities may find themselves lacking or unworthy when exposed to photos and videos of naked models and pornography stars; this is another major concern. Unease due to body image is more virulent than ever. It isn't known to what extent the social media is or is not inflicting a plethora of self doubt and physical insecurity (Jiotsa et al., 2021).

Since there is no interactional evidence prevalent in the culture and neither such data exists in the scientific community due to ethical restraints, it is not known how young people feel and know what is appropriate and what isn't in case of sexual bullying and if they feel confident of what's okay and what isn't while using social media. Whether and to what extent the young generation is aware of maintaining a privacy boundary for their safety isn't entirely comprehended, despite knowing that the internet is a permanent place of online content and everything leaves a digital footprint (Olinder et al., 2020). Once things are out on the internet, they can remain there indefinitely.

Only those who experience and live with social media on a day-to-day basis can explain to what extent it is an obligation or mess of their lives. The force of social media that it imposes through its pros and cons in real life needs to be pictured so that the uncertainty and vagueness about its impact can be made distinctive and sharpened, which is not possible unless the speculations mentioned above are approached with an aim to providing a scientific answer regarding "how and what" in the media impacts the perception of the real world of these individuals. This will lead to effective measures that can be taken to protect the youth from the supposed disadvantages.

Justification for the Study

The paucity of in-depth understanding of how impact of social media is perceived, especially among educated and informed classes of the society who have faced negative consequences themselves, directs towards a need for better comprehension. It is essential to know how they interpret the weight of social media on their own mental health and the measures to tackle its impact.

Therefore, this research paper attempted to understand how the "educated section" of society "using social media on a regular basis" and "had formerly experienced negative events" using it "perceive social media usage, its negative & positive influences on mental health and possible interventions in the present" that can be further proposed for policy changes.

Aim of the Study

This study aimed to gain an in-depth understanding of how individuals representing the educated section of the Bengali society with negative exposure to social media perceive the impact of social media on mental health and probable suggestions they have as interventions for dealing with it.

Research Methodology

To convene the objective of the study, a focused group discussion (FGD) was performed, as this method is appropriate for presenting impending and original postulations, participants' views and opinions. The interview was carried out on a sample of 7 partakers chosen through purposive sampling and the researcher moderated throughout the interview.

Table 1: Characteristics of the Participants

Participant 1	Gender and origin: Male, West Bengal Age and profession: 35 years, Research Scholar Educational Level: PhD (pursuing) Social Media Usage Daily: Yes, History of being cyber stalked Hours of Social Media Usage: More than 10 waking hours
Participant 2	Gender and origin: Male, West Bengal Age and profession: 37 years, Marketing Manager Educational Level: MBA Social Media Usage Daily: Yes, History of online sexual harassment. Hours of Social Media Usage: More than 15 waking hours
Participant 3	Gender and origin: Female, West Bengal Age and profession: 39 years, School Teacher (PGT) Educational Level: Masters, M.Ed Social Media Usage Daily: Yes, history of account being hacked. Hours of Social Media Usage: 6-8 waking hours
Participant 4	Gender and origin: Female, West Bengal Age and profession: 42 years, Physician (Dermatologist) Educational Level: MBBS, MD Dermatology Social Media Usage Daily: Yes, history of both children with cyber bullying Hours of Social Media Usage: 2 – 2.5 hours roughly
Participant 5	Gender and origin: Female, West Bengal Age and profession: 45 years, Consultant Clinical Psychologist Educational Level: M.Phil in Clinical Psychology Social Media Usage Daily: Yes, deals with clients of internet addiction Hours of Social Media Usage: 6-7 hours daily
Participant 6	Gender and origin: Male, West Bengal Age and profession: 41 years, Social Media Influencer Educational Level: MA Social Media Usage Daily: Yes, had identity theft & misuse on social media Hours of Social Media Usage: 14- 16 hours, heavy use.
Participant 7	Gender and origin: Female, West Bengal Age and profession: 43 years, Researcher Educational Level: PhD, Post- Doc Social Media Usage Daily: Yes, history of internet addiction Hours of Social Media Usage: 3-4 hours daily

Description: The participants selected had past negative exposure to social media usage, the highest educational qualification being a Masters's Degree in a relevant discipline and the age range of 35 to 45 years.

Inclusion and Exclusion Criteria

- Participants for the study were chosen based on the following inclusion criteria:
- Having regular social media use with at least 2 hours of daily engagement
- Prior negative experiences from social media usage
- Minimum educational qualification of Masters in any relevant area
- Age range: 35- 45 years
- Must belong to the Bengali community

Exclusion criteria

- Anybody not giving consent to participate in the study
- Anyone with prior experience of parta-king in a similar kind of research activity

Data Collection and Analysis

The questions for the interview were pre-decided by the researcher; new questions were data-driven and were prompted by the researcher during the interview process. The interview took place under controlled conditions at an official setup. The duration of the interview was 40 minutes. The language used for the interview was English. The complete interview was recorded in audio format with the consent of the participants and transcribed later for analysis purposes.

The data was thematically analyzed to generate themes and sub-themes for an in-depth understanding of the perceived impact of social media on mental health among the sample. The raw data was structured into codes and themes as per the steps as follows:

- Familiarization- the researcher read the transcripts multiple times to get accustomed to the data
- Identifying thematic framework- to support the theory-based strategy of positive & negative social media impact on mental health and possible interventions, a thematic framework was followed.
- Indexing- additional codes and themes were derived from the data
- Mapping- Quotes from the interview were assigned under codes, and these codes were rearranged to the right theme.
- Interpretation- finally, with the analysis, the process was completed.

This method has been adapted from the framework model to ease data collection and investigation for the current exploration (Pope et al., 2000). Lastly, findings have been compared and corroborated with the available literature. Ethical considerations were duly maintained in terms of informed consent, prior agreement for participation and confidentiality of the participants' identity throughout the interview as well as during transcription of data and analysis process.

Results

The verbatim references provided insights into the participants' views and experiences, illustrating the main themes of the discussion. Based on the verbatim references provided in the focused group discussion on how social media impacts youth mental health, several sub-themes have been identified within the main themes. These sub-themes have offered a more detailed understanding of the participants' perspectives. The data is represented as below:

Table 2: Optimistic Perception among the Participants

Theme	Sub Theme	Illustrative Quotes from the interview
Positive Impact of Social Media	Emotional Support and Connection	"I think social media can be a platform for emotional support and connection. It helps young people like me to find like-minded individuals and communities that can provide a sense of belonging." (P1)
	Dissemination of Mental Health Information	"I agree. It also allows for the propagation of mental health information and resources, which can be beneficial for youth seeking help or information." (P3)
	Raising Awareness to reduce Stigma	"Social media can be a powerful tool for raising awareness of mental health issues. I have seen that actually. It's a platform where young people can share their stories and reduce the stigma surrounding mental health." (P6)

Table 3: Harmful Aspects of Social Media

Theme	Sub Theme	Illustrative Quotes from the interview
Concerns and Negative Impacts	Comparison and Low Self-Esteem	"One concern I have is the constant comparison that happens on social media. Young people often compare their lives to the curated and idealized versions they see online, which can lead to feelings of inadequacy and low self-esteem." (P2)
	Cyberbullying	"I'm worried about cyberbullying. My children have faced online harassment, and I've seen the devastating impact it can have on their mental well-being." (P4)
	Anxiety and Depression due to Pressure to Conform	"As a mental health counsellor, I've noticed that excessive social media use can contribute to anxiety and depression, especially when young people feel pressured to maintain a certain image or keep up with trends." (P5)
	Balancing Online and Offline lives to reduce risk of addiction	"I think there's also a risk of addiction. Social media platforms are designed to keep users engaged, and some young people may struggle to find a healthy balance between online and offline life." (P6)
	Sleep Disturbances	"From a research perspective, I've seen studies linking heavy social media use to sleep disturbances and reduced face-to-face social interactions, which can impact overall mental well-being." (P7)
	Information Overload due to overwhelming content	"I've observed that social media can sometimes lead to information overload. Young people are bombarded with news, opinions, and images, which can be overwhelming and contribute to stress." (P3)
	Fear of Missing Out (FOMO) and anticipating social exclusion	"Additionally, the fear of missing out is real. Seeing others' seemingly exciting lives and experiences online has made many of my friends, family and even I feel left out, which can negatively affect our mental health." (P1)

Table 4: Prospective Suggestions

Theme	Sub Theme	Illustrative Quotes from the interview
Potential Solutions and Strategies	Digital Detox and Screen Time Management	"To address FOMO and comparison, it's crucial for individuals to practice digital detox and limit their screen time. Encouraging young people to take breaks from social media can help them regain perspective." (P1)
	Education and Digital Literacy	"Schools can play a role by including digital literacy and mental health education in the curriculum. Teaching students how to critically evaluate online content and manage their digital well-being is essential." (P3)
	Open Communication	"Parents should maintain open communication with their children about their online experiences. Creating a safe space where kids can talk about any issues they encounter online is vital." (P4)
	Early Intervention	"As mental health professionals, we should be proactive in offering support and resources for youth dealing with social media-related stress. Early intervention can make a significant difference." (P5)
	Responsible Content Creation	"Content creators, like myself, should be mindful of the impact our content can have on young audiences. Promoting authenticity, positivity, and responsible online behavior is essential." (P6)
	Policy Considerations for Content Moderation	"Policymakers can consider regulations or guidelines for social media platforms to encourage responsible content moderation and limit the exposure of young users to harmful content." (P7)
	Promoting Offline Activities	"Encouraging offline activities and hobbies is crucial. Schools and parents can promote extracurricular activities that allow young people to disconnect from screens and engage in real-life experiences." (P2)

Table 5: Role of Consumers

Theme	Sub Theme	Illustrative Quotes from the interview
Collaborative Approach	Youth Involvement	"Absolutely, and it's also crucial for young people themselves to be part of this conversation and advocate for their own well-being." (P1)

Discussion

Table 2 is reflective of participant quotes depicting their "perception regarding the positive impact of social media" on youth mental health. The chief sub-themes that have been distinguished are three in number with supportive verbatim data. The

first eminent sub-theme, "emotional support and connection", provides insight into participants' understanding of reasons for dependency on social media as they attribute its usefulness to discovering like-minded individuals and communities that provide them with a sense of belongingness. Literature corroborating this finding indicates that social media is a place where youth seek meaningful connections that, over time, displace the social reality of youth, which consists of face-to-face enriching and deeper social interactions (Smith et al., 2021).

Another sub-theme, "dissemination of mental health information," is indicative that youth who seek mental health supervision for psychological issues they deal with often seek information from social media as they consider it as beneficial. This finding, too, is confirmed in literature as studies have shown a high level of reliability that youth develop towards information that is being circulated over social media (Majerczak et al., 2022). However, when information is pertaining to physical and mental health, the credibility of these is much in speculation due to factors such as internet bots, fake accounts, clickbaits, filter bubbles, and even internet trolls (Buckels et al., 2014).

The third sub-theme, "raising awareness", is reflective that youth perceive social media as a platform for sharing stories and reducing stigma surrounding mental health. This belief among youth is authenticated through a unique literature stating that there is a strong positive relationship between the components of social media campaigns, public awareness and behavioural change, and hence with this scope, youth might opt to share over social media, their personal experiences for better reach and spreading knowledge (Abuhashesh et al., 2021)

Table 3 pertains to "concerns and negative impacts of social media on mental health" as perceived by the participants. There have been 7 sub-themes identified under this broader theme that have emerged from the data. Participants suggested that today's youth engage in comparing themselves constantly with whatever they see online. If the comparisons lead to the realization that one is not close to how one is supposed to be with respect to the ideal conceptualizations of self, it leads to feelings of inadequacy and low self-esteem. This finding is supported by studies suggestive of social media usage leading to depression, feelings of isolation and shrinking self-esteem (Andrade et al., 2023).

Participants raised concerns regarding cyberbullying and its devastating impact on mental well-being due to extreme online harassment that is faced by youth today, especially teenagers who are novices on social media usage. This finding is confirmed through major studies stating that adolescents who underwent online harassment developed depressive symptoms compared to those who were never exposed to cyberspace nuisance (Maurya et al., 2022).

Participants expressed that the propensity to develop psychiatric conditions, such as anxiety and depression, is prevalent among young people with excessive social media use. The pressure to conform has been reasoned as the cause for it, which means youth often face the pressure to uphold a certain image to keep up with the trends to maintain their status quo within society. Investigational studies showing how peer pressure considerably predicted adolescents' addictive usage of social media and consequent co-morbid psychiatric states support this notion held by the participants (Xu et al., 2023).

Participants emphasized that the engaging design of social media platforms keeps the users engaged and can cause addictive tendencies. Therefore, this necessity for a healthier balance between online and offline life has been pressed by the participants. A study by Lin, Su & Potenza, 2018, suggests that online and offline integration is eminent to unite self-identity and interpersonal functioning supports this stance. Also, it is suggestive that subjects practising a balance between online and offline life experience higher life fulfilment and lower internet dependence.

It was opined by the participants that constant flow of news, opinions and images can get psychologically overwhelming and contribute to stress due to information overload. Jiang & Beaudoin, 2016 also suggested that individuals using social media face too much information or the complexity of information might go beyond processing capacity.

The sub-theme of "fear of missing out (FOMO)" is indicative that participants have experienced feelings of being left out if do not check their social media handles constantly. Also, frequent monitoring of others' seemingly exciting lives while not being in a capacity to experience the same, can direct towards the feelings of social exclusion and distress. This appends to the negative effect on mental health. Consistent with this view, one study suggested raising awareness of the psychological effects of social media usage in consideration of social comparison and the precedential anxiety that results (Alabri. A., 2022)

Table 4 comprises the theme of "potential solutions and strategies" as suggested and perceived by the participants. There are 6 sub-themes that have been identified under this theme with corresponding data. Participants have proposed that taking breaks from social media is essential for regaining a balanced perspective towards self and others. Reducing screen time, as per participants, is essential for digital detoxification. An expert study complements this belief as it states that boundless use of technology results in major physical and psychological disorders. So, digital detoxification needs to be sustained by old methods, such as gardening, artwork, and reading, in order to divert the mind from tech devices (Bhattacharya et al., 2019).

Beginning from the school level, the importance of digital literacy in order to facilitate the critical evaluation of online content that one is exposed to and the consequent outcome on mental health has been argued by the participants. A relevant experimental study is indicative that with the introduction of digital literacy programs, there were reportedly larger improvements in functional skills and psychiatric outcomes amongst the populace with serious mental conditions due to excessive internet consumption (Camacho, E. &Torous, J. 2022).

The importance of open parental communication has been acknowledged by the participants in order for children to share their online experiences without hesitation. They emphasized the significance of a safe space where concerns can be communicated without delay before it becomes a mental health issue. This area is quite under-researched as one bibliometric study highlights current research trends for cyber parental control and has mixed opinions regarding providing a safe Internet environment by making parents practice control over using Internet access (Altarturi et al., 2020).

As per participants, youth dealing with social media stress ought to be provided with early intervention in the form of psychological services like counselling, therapy and medications, whichever is necessary. Also, proactive

support in terms of resources and accurate information regarding where to seek help needs to be given to make a noteworthy impact in their lives. Although much of the literature doesn't directly talk about any forms of psychotherapy designed to cater to social media or internet addiction, a review study is suggestive that cognitive restructuring and psychotherapeutic strategies might facilitate individuals tormented by social media addiction due to unmet needs for real-life relationship satisfaction (Xuan et al., 2020).

The necessity of responsible content creation to promote authenticity, positivity and mindful online behaviour on the part of users has been recommended by the participants. This recommendation is supported by literature stating that in today's time, any online content or post has the capacity to quickly influence millions of people, especially adolescents with limited cognitive faculty, to judge the worth of the content, persuading people to do and not do certain behaviour (Yuvarani et al., 2021).

Regulatory guiding principles for social media spaces to encourage responsible content upload to regulate and channel the exposure of harmful content to young users need to be under policy consideration as per participants. This notion is supported in the literature as essential elements for social media policy that have been identified but not implemented stringently are citizen conduct, legal issues, content, acceptable use and security (Hrdinová et al., 2010).

Participants have the opinion that for young individuals, especially adolescents, encouraging offline activities and hobbies, & promoting extracurricular activities can allow them to disconnect from screens while engaging in real-life experiences. Multiple studies confirm this view indicating that offline activities can enhance the quality of social relationships shared both online and offline (Falavarjani et al., 2019).

Table 5 showcases the value of collaboration among the youth in advocating the significance of reasonable social media usage and subsequent mental health. While not much literature identifies the importance of youth involvement, nations have already been called upon to advocate actively and put mental health to the core front by the World Health Organization. Mental health is the agenda can be put forward with the collective efforts of policymakers at the government level, advocacy groups, mental health professionals, families and organizations (Funk et al., 2015). Hence, anything, including excessive social media usage, that impacts mental health and subsequently alters physical health must not be taken lightly and should be proactively taken under advocacy initiatives.

Conclusion

In concluding remarks, it can be affirmed that the current study provides an in-depth understanding of how individuals who have had negative experiences with social media don't necessarily view using social media as totally negative. Rather, they have a balanced perspective and view the impact of using social media on mental health both positively and negatively. Accordingly, they have suggested measures to tackle the negative exposure, most of which have been long-established through scientific investigations. It becomes essential, henceforth, to not take social media consumption for granted, as with good aspects, it comes with a myriad of negative exposure which has the full potential to impact one's psychological health in a detrimental way. This research paper discusses the need to

seriously take advocacy of the internet and handling of social media with its psychological impact on policy changes.

Recommendations

Educational institutions and parents need to emphasize digital literacy programs that can help individuals critically evaluate online content. These programs should equip young users with the skills to discern credible information from misleading or harmful content.

Encouraging open, safe space and non-judgmental communication about online experiences is crucial. This can help in early interventions to prevent or tackle mental health concerns arising from social media use. It is essential to educate youth about the significance of balancing online and offline activities, and promote breaks from social media, diversifying offline hobbies and extracurricular activities that enhance mental health.

Psychological issues exacerbated by excessive social media use require intervention through services of counseling and therapy, and therefore, mental health advocacy is recommended. Policymakers and social media platforms have to stringently implement regulatory guidelines that check answerable content creation and appropriate content upload.

Lastly, the youth of today is encouraged to advocate for responsible social media usage and mental health awareness as their voices will play a noteworthy role in influencing policy changes and public awareness campaigns.

Further Scope of Investigations

Future research can delve deeper into the existing regulatory guidelines and their effectiveness in protecting the youth from harmful content on social media in addition to overall online environment and user experiences prevalent in today's time.

The efficiency of digital literacy programs in equipping young minds with skills to critically evaluate online information can be assessed to highlight the impact of such programs on mental health outcomes.

Investigating the function of parental control and its consequence on creating a secure online atmosphere for children can be a valuable area of study.

Also, further studies can focus on the development and evaluation of specific interventions and psychotherapeutic strategies aimed at mitigating the result of excessive social media use on mental health.

Finally, an investigation into the involvement of youth in advocacy initiatives and the actual impact of their efforts on policy changes and mental health awareness is a promising area of study.

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Research Article

Implementing the Revised Bloom's Taxonomy (2001) in AI-Digital and Online Learning Environments: A Strategic Approach

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Abstract

Integrating digital technology in 21st-century education requires a strategic, transformative pedagogical approach to enhance learning outcomes and skill development. As educators, researchers, and policymakers, our role shapes this future. The Revised Bloom's Taxonomy (2001) offers an essential framework for structuring educational objectives in AI-driven and online learning environments, where cultivating higher-order thinking is paramount. This study explores the strategic application for designing and assessing learning objectives within digital pedagogy, categorizing activities that bolster analytical, creative, and evaluative skills. This taxonomy is a foundational tool for structuring digital learning experiences that meet contemporary educational needs.

The research provides a theoretical analysis of how the taxonomy's hierarchical approach aids in crafting objectives aligned with advanced digital tools and interactive platforms, enhancing engagement and competency. It also examines alternative revisions to the taxonomy, focusing on the 2001 model, which emphasizes active, dynamic learning. This alignment enables clear and adaptable learning goals that promote effective digital learning and assessment practices, guiding students toward key educational objectives in a technology-enhanced environment despite challenges related to technology access and varied educational contexts.

Keywords: learning objectives, digital pedagogy, Revised Bloom's Taxonomy, AI-digital learning environments, higher-order thinking

Introduction

Incorporating advanced technology in modern education has markedly altered how learners engage with material and obtain new knowledge. Wireless

connectivity, including Bluetooth, facilitates connections among devices such as cameras, laptops, and desktops, streamlining network configurations and enhancing digital interactivity. Smartphones with advanced functionalities provide immediate access to multimedia, gaming, and communication via straightforward screen interactions (Kroski, 2008). Digital tools function as personal assistants, spanning educational, social, and professional domains to improve learning accessibility (Roschelle et al., 2005).

Digital technology is adaptable and meets various learning requirements, improving engagement, facilitating collaboration, and guaranteeing equitable access to resources, particularly for marginalized groups (Duncan-Howell & Lee, 2007). These tools enable students to control their learning, enhancing academic and social skills while connecting education to practical applications.

Methodology adopted for this approach

This research employs a thoughtful, multi-phase approach to incorporate the Revised Bloom's Taxonomy (2001) with AI and digital tools in online learning settings.

Framework Analysis: The study thoroughly examines the Revised Bloom's Taxonomy to grasp its hierarchical structure of cognitive domains, ranging from basic skills like remembering and understanding to advanced skills such as evaluating and creating. The relevance of these domains to current educational goals is carefully assessed (Anderson & Krathwohl, 2001).

Integration with Digital Tools: Cutting-edge AI technologies and digital learning platforms must align with the cognitive domains and determine their suitability. Key strategies, including interactive quizzes and AI-based analytics, are identified to enhance student engagement and knowledge retention (Nehru et al., 2023).

Pedagogical Design: Learning scenarios crafted to connect each level of Bloom's taxonomy with appropriate digital tools include developing templates and online course structures that systematically integrate AI tools across all cognitive levels (Nehru et al., 2023).

Case Study/Implementation: The methodology virtual classrooms or online environments. Pilot studies to test its practicality, offering a real-world demonstration of the theoretical framework.

Feedback and Iteration: Feedback from educators and students through surveys and interviews. The process is iterative, refining the framework to ensure it remains adequate and relevant (Nehru et al., 2023).

Outcome Evaluation: The model's success is measured by assessing learning outcomes. Comparative studies with traditional teaching methods to highlight the improvements achieved in meeting educational objectives.

Advocate for a fundamental overhaul of Instead proposes adjustments to meet the needs of Millennials and Generation Z, who thrive in digital, interactive learning environments. Bloom's Revised Taxonomy has long guided educators in setting learning objectives, designing curricula, and structuring assessments across cognitive levels (Anderson & Krathwohl, 2001; Joyce & Weil, 1996). However, the digital preferences of modern learners necessitate adaptations to this framework for alignment with technology-rich modalities (Taylor, 2005).

Andrew Churches (2009) extended Bloom's framework into Bloom's Digital Taxonomy, incorporating technology-

driven activities that support active learning. This adaptation integrates digital tools—that foster engagement and critical skills (Cheal, 2007). principles, the digital taxonomy promotes analysis, evaluation, and synthesis, which is crucial for 21st-century learning.

This paper recommends analyzing digital technology's role within Bloom's Taxonomy. It suggests enhancements to support cognitive development and engagement for digital-native students without requiring a complete framework revision.

A review of methodology and approach

This framework is designed for proficiency in digital technologies, referred to as Millennials. Historically, educators have employed set assessments at various cognitive levels (Anderson & Krathwohl, 2001; Joyce & Weil, 1996). However, the unique learning styles and preferences of Millennials, proficient in digital and online interactions, highlight the need to adapt Bloom's model to inclinations (Taylor, 2005).

Andrew Churches (2009) proposed adapting digital education and leveraging digital tools to enhance active learning through journaling, collaboration, role-playing, and problem-solving (Cheal, 2007). This framework integrates digital artifacts to strengthen higher-order thinking skills, engaging students in constructivist learning and fostering critical analysis, evaluation, and synthesis of information.

This study utilizes a comprehensive methodology to analyze the connection between Bloom's Revised Taxonomy and digital learning environments. The proposal aims to use digital tools to enhance cognitive engagement and improve the educational experience for modern technology-oriented learners rather than suggesting a significant restructuring. This strategic approach advocates for integrating AI and digital platforms to enhance interactive and personalized learning experiences that align with the skills required for the digital era.

The Emergence of Digital Learning

Table-1: How the digital technology has evolved over the past couple of decades (from Crompton, 2014)

Year	The Evolution of mobile technologies
1970s	The Motorola DynaTAC 8000X was first released. 1st microcomputer, VHS (Video Home System) videotape recorder, floppy disc, and object-oriented programming language Smalltalk. GUI (Graphical User Interface) aided programme access and execution.
1980s	Start manufacture first videotape-sized handheld computers (laptops) including a word processor, spreadsheet, calendar, and address book. Desktop computers arrive gradually. Networking between computers was established for social sharing.
1990s	The first web browser, digital camera, graphical calculator, multimedia computers, and palm pilots were used in educational settings. A palm pilot includes a calculator, notebook, contacts, photographs, and reminders. The growth of socio-constructivist learning has enhanced scientific community interaction and mobility.
2000s	Unlike microcomputers, mobile phones were smaller and more accessible. Tablets like the Microsoft Tablet PC and Wibrian were introduced and used in schools. Virtual learning environments (VLEs) such as Blackboard and Moodle were created to help students learn online. Apple introduced iPhone with a built-in computer, accelerometer, compass, navigation, camera, and videophone system. Then came the Motorola Xoom and Apple iPad.
2010s	Machine to mobile machine connectivity (IoT) has made virtual anything more intelligent. Mobile phones were more innovative, accessible, and connected to other mobile gadgets. - Wearable devices like the iWatch and Google Glass are now being employed in schools. The semantic web allows users to find the correct information at the right time and location. Virtual reality has begun to help students learn, especially in health and marketing.
2020-2022	Artificial Intelligence and Machine Learning (A.I. and M.L) Process Robotics (RPA) Edge Computing- Enviro-Com Quantum Computing-Quasi-Com Virtual Reality and Augmented Reality(VR/AR) and Mixed Reality Blockchain IoT (IoT) and 5G

A Strategic Approach

Due to technological advancements that have incorporated digital devices into daily life, digital learning has undergone significant transformation since the 1970s. Electronic learning tools are always ubiquitous and available in locations, transforming the knowledge acquisition process. The ongoing development of digital tools, as illustrated in Table 1, indicates a dynamic educational ecosystem propelled by progressively sophisticated and accessible devices.

In the past two decades, increased accessibility to digital devices has heightened interest in digital learning have promoted global education, highlighting the potential for improved learning and mobility, offering a crucial framework for digital learning, facilitating cognitive engagement and the development, analyzing, and creating.

Effective digital learning depends on a cohesive ecosystem in which technology facilitates significant outcomes. Traxler (2009) and Hamm et al. (2014) highlight the significance of learner and device mobility in influencing the timing, location, and manner of learning. In AI-driven online settings, Bloom's framework is utilized via VOIP, text, digital television, and web tools (Ozan et al., 2015), promoting foundational knowledge and creative problem-solving. This method integrates digital pedagogy with Bloom's objectives, facilitating cognitive development in the contemporary educational environment.

The Necessity of Adopting Digital Pedagogy

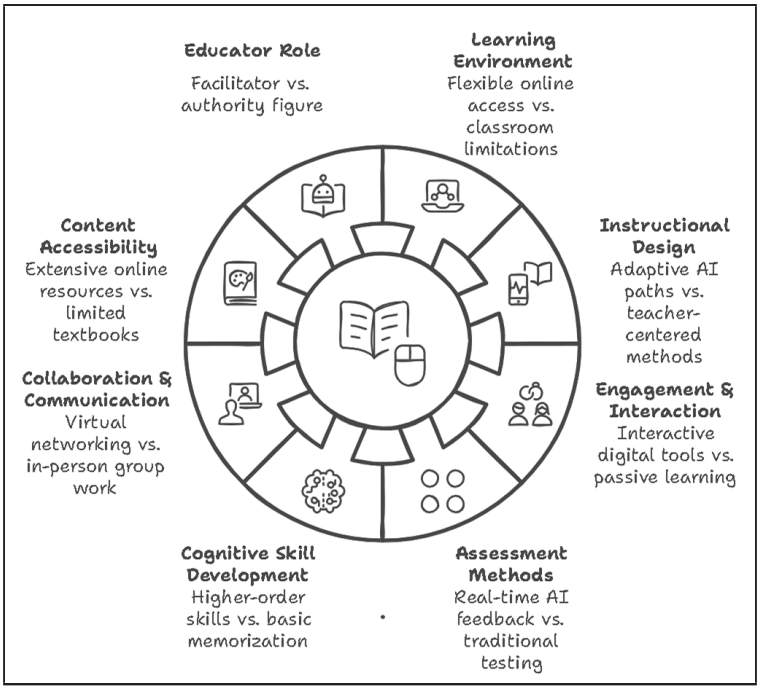
Advances in digital learning are still evolving, presenting immense growth potential. Educators and researchers must integrate innovative educational frameworks, such as the Revised Bloom's Taxonomy (2001), to stay relevant as students increasingly turn to digital tools (Papadakis et al., 2021). This taxonomy offers a structured approach for cultivating higher-order thinking in digital settings, facilitating nuanced, layered knowledge and skill development.

Today's learners exhibit unique digital habits and preferences, which, along with institutional support for AI-driven learning, underscore the necessity for pedagogical evolution aligned with digital demands. The accessibility of digital tools, from tablets and computers to advanced AI platforms, enables students to access resources, collaborate, and engage with instructors on digital platforms.

Digital pedagogy grants learners unprecedented flexibility to complete assignments, participate in discussions, and explore subjects (Criollo et al., 2021). Social media and collaborative tools like Facebook, Diigo, and Delicious enhance interactions and support learning inside and outside the classroom. Multimedia platforms like YouTube, TikTok, and Vimeo introduce dynamic, interactive elements that engage diverse learning styles, reinforcing learning experiences.

Implementing the Revised Bloom's Taxonomy within AI-enhanced digital environments provides strategic advantages. By aligning learning objectives across cognitive levels, educators can craft adaptive, immersive, and critical thinking-focused experiences that meet modern learners' evolving needs and expectations.

Figure-1: Traditional vs. AI Digital Learning


Educator Role
Facilitator vs. authority figure
Learning Environment
Flexible online access vs. classroom limitations
Content Accessibility
Extensive online resources vs. limited textbooks
Instructional Design
Adaptive AI paths vs. teacher-centered methods
Collaboration & Communication
Virtual networking vs. in-person group work
Engagement & Interaction
Interactive digital tools vs. passive learning
Cognitive Skill Development
Higher-order skills vs. basic memorization
Assessment Methods
Real-time AI feedback vs. traditional testing

Embracing digital pedagogy is essential and responsive to the broader cognitive, social, and digital competencies that today's learners require. Educators can craft targeted, strategic approaches that cultivate critical skills for the 21st century by integrating the Revised Bloom's Taxonomy with AI and digital resources.

Promoting Meaningful and Effective Online Learning

Govindasamy (2002a) underscores the significance of crafting online environments. As digital learning advances beyond traditional e-learning and distance learning, it offers flexibility unbound by time and location, enhancing educational experiences (Traxler, 2009). This transition marks a shift from static e-learning to dynamic digital learning models characterized by adaptability, immediacy, and personalization.

Historically, e-learning has referred to structured, multimedia content with interactive elements, while digital learning provides greater spontaneity and customization, aligning closely with individual learner needs (Laouris & Eteokleous, 2005; Friesen, 2005). Leveraging artificial intelligence (AI) and the Revised Bloom's Taxonomy (2001), educators can design highly personalized learning experiences, fostering engagement with cognitive skills ranging from basic recall to complex creation.

In AI-integrated digital platforms, learning becomes adaptive; AI systems align challenges with each student's cognitive level, encouraging higher-order thinking. Such platforms might offer assessments that escalate in complexity, enhancing knowledge application and making learning journeys more efficient and impactful. This synergy of AI, digital learning, and Bloom's Taxonomy supports the creation of meaningful educational experiences tailored to modern learners' needs.

AI-Digital Learning vs. E-Learning: Navigating the Terminology

In recent years, the terminology surrounding "digital learning" and "e-learning" has become central to discussions on education and professional training in technology-enhanced environments. Although these terms are used interchangeably, each represents distinct aspects of modern learning with significant implications for strategic implementation. Clarifying and aligning these terms with specific learning outcomes is essential to fully leverage the Revised Bloom's Taxonomy (2001) in AI-driven educational spaces.

Distinguishing AI-Digital Learning and E-Learning in Technology-Enhanced Education

"AI-digital learning" has become essential in professional education due to the growing demands for mobility and continuous workforce training. Digital learning includes various that promote ongoing skill acquisition and career development. Char Characterized adaptability, digital learning integrates self-paced content with immersive, synchronous experiences, feedback loops, and multi-environment progress tracking. This blended structure, merging online and offline elements, creates interactive and collaborative learning spaces, offering field-based opportunities that enrich learning (Nehru, 2014).

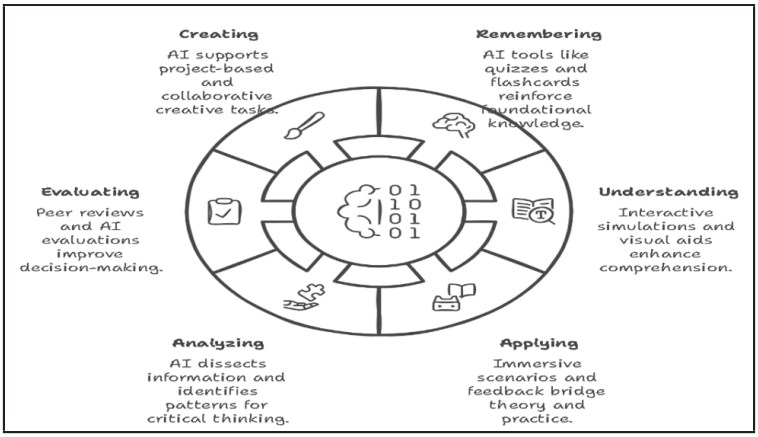
In contrast, e-learning is entirely online and accessible remotely, focusing on self-paced instruction, digital content, and assessments. Although flexible, e-learning needs more interactive and blended elements in digital learning. When applying Revised Bloom's Taxonomy in AI-enhanced settings, digital learning supports higher-order skills—analyzing, evaluating, and creating—while e-learning, traditionally aligned with lower-order skills like remembering and understanding, can be enhanced to encourage critical thinking through AI-driven adaptations.

Leveraging AI-Powered Digital Learning Environments

Frameworks allow educators to design AI-driven experiences that cater to each cognitive level. For example:

1. **Remembering:** In e-learning environments, AI can deliver and reinforce foundational knowledge through quizzes, flashcards, and spaced repetition algorithms.
2. **Understanding:** AI-powered tools can assist learners in comprehending new material by providing interactive simulations and visualization aids.
3. **Applying:** Digital learning offers an environment where learners can apply knowledge through immersive scenarios and real-time feedback, bridging theoretical learning with practical application.
4. **Analyzing:** AI algorithms can help learners dissect complex information, compare concepts, and identify patterns, especially in digital learning settings where blended experiences encourage critical thinking.
5. **Evaluating:** Digital learning's comprehensive resources allow learners to engage in peer reviews, self-assessments, and AI-supported evaluations, making informed judgments and improving decision-making skills.
6. **Creating:** AI's role in digital learning can be transformative in creative tasks, supporting project-based learning, collaborative workspaces, and innovation-driven exercises that culminate in original outputs.

Figure-2: AI Integration in Digital Learning


Creating
AI supports project-based and collaborative creative tasks.
Remembering
AI tools like quizzes and flashcards reinforce foundational knowledge.
Evaluating
Peer reviews and AI evaluations improve decision-making.
Understanding
Interactive simulations and visual aids enhance comprehension.
Analyzing
AI dissects information and identifies patterns for critical thinking.
Applying
Immersive scenarios and feedback bridge theory and practice.

Understanding the differences between digital learning and e-learning can help educators and learners strategically implement Bloom's Taxonomy within AI-powered platforms, ensuring learning outcomes across a spectrum of cognitive levels. As educational technology evolves, recognizing the unique affordances of digital and e-learning can guide institutions in creating more effective, inclusive, and strategically aligned learning experiences in online and digital settings.

The Growth and Development of Bloom's Taxonomy Concerning Education and Technology

The significance of endured from foundational teachings continues to influence contemporary learning frameworks (Johnson et al., 2013). However, methods and foundational educational frameworks have retained their importance. One such framework provided educators with a robust model for understanding processes. It aims to help educators define what students should achieve and comprehend through structured educational experiences (Krathwohl, 2002). Bloom's Taxonomy integrates educational and psychological perspectives, aligning teaching objectives with insights into learning (Bloom et al., 1956, p. 6).

The Foundation of Bloom's Taxonomy: First Generation

In educational practice, learning is divided into three fundamental domains: cognitive, affective, and psychomotor (Bloom et al., 1956). This classification allowed educators to view learning through simple and complex lenses, making teaching more systematic. Bloom originally developed the taxonomy to standardize education goals and facilitate efficient preparation for comprehensive exams by reducing the workload on educators (Krathwohl, 2002). In 1949, Bloom collaborated with experts to finalize this framework, which was later published in Psychiatry and Humanities (Bloom et al., 1956). According to Krathwohl, Bloom's taxonomy had several objectives:

- Establishing a shared language regarding educational goals for students, educators, and administrators.
- Offering a framework for defining objectives across courses or curricula.
- Ensuring coherence between instructional objectives, learning activities, and assessments.
- Establishing a basis (Bloom et al., 1956, p. 14). Objectivity may differ

based on various educational philosophies and priorities (Furst, 1981).

The Revised Bloom's Taxonomy: Second Generation

In 2001, Anderson and Krathwohl revisited and refined the model to better align with contemporary educational requirements. They retained the core structure of the taxonomy while introducing modified names and eliminating previous classifications, refining the remaining three to better align with the expanded objectives of the taxonomy. This revision presented a dual-dimensional framework integrating knowledge types and cognitive processes, enhancing adaptability to the changing requirements of education (Krathwohl, 2002). Growe (2011) observed that these changes represented a shift from conventional knowledge transfer models, aligning education with the necessary skillsets for a rapidly evolving world.

Knowledge Dimension: The revised taxonomy retained the original knowledge classifications while adding a new category: metacognitive knowledge, emphasizing awareness and mindfulness of one's cognitive processes (Krathwohl, 2002). This fourth category extended the taxonomy's ability to capture self-awareness in learning, a crucial skill in modern education and digital learning environments.

Cognitive Dimension: Substantial updates in the mental dimension redefined the six categories and incorporated action verbs to clarify the educational goals within each level (Krathwohl, 2002). "Remembering" became a broader concept synonymous with "understanding," merging some elements of knowledge and comprehension. The categories of application, analysis, and evaluation, while "synthesis," were restructured to enhance each cognitive level's depth and applicability (Krathwohl, 2002). These updates gave educators more flexibility in designing learning experiences aligned with higher-order thinking skills and diverse learning activities.

Integration in AI-Enhanced and Online Learning Environments

A strategic framework for setting educational objectives in AI-driven and digital learning environments. This two-dimensional structure enables educators to craft learning experiences that cultivate cognitive depth and metacognitive awareness, which is essential for self-directed digital learning. By fostering self-regulation and reflective abilities, metacognitive skills enhance student autonomy. Modernized with active verbs, the taxonomy's cognitive categories seamlessly integrate with AI-enabled instructional design, supporting adaptive feedback and personalized learning pathways.

This synergy between Revised Bloom's Taxonomy and digital education supports structured, responsive learning activities and assessments. Embedding these principles into digital platforms empowers educators to cater to diverse learning styles and boost engagement while building essential analytical, creative, and evaluative skills. This approach transforms traditional educational methods, preparing learners for success in an adaptive, AI-enhanced world.

AI-Enhanced Digital Learning Utilising Revised Bloom's Taxonomy

The Revised Bloom's Taxonomy provides a strategic framework for setting educational goals within AI-driven and digital learning contexts. Its dual-dimensional model allows educators to

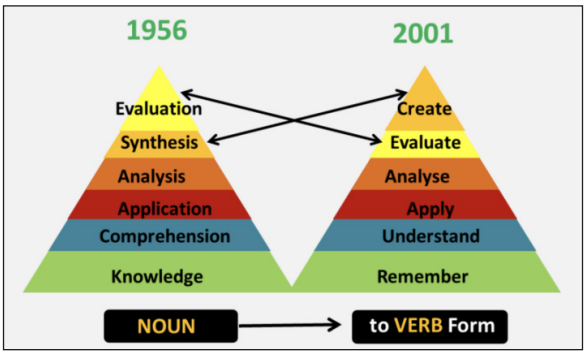
create experiences that foster cognitive depth and metacognitive awareness—essential for self-directed digital learning. Emphasizing metacognitive skills encourages self-regulation and reflection, enhancing student autonomy. The taxonomy's updated cognitive categories, expressed with active verbs, align seamlessly with AI-based instructional design, supporting adaptive feedback and personalized learning paths.

Integrating Revised Bloom's Taxonomy with digital education is about more than just structured, responsive learning activities and assessments. It is about preparing students for success in a flexible, AI-enhanced educational landscape. By embedding these principles into digital platforms, educators can accommodate diverse learning styles, boost engagement, and cultivate critical analytical, creative, and evaluative skills. This ApproachApproach redefines traditional education, ensuring that students are well-equipped for the future.

1. **Leveraging AI for Descriptive Communication**: AI-powered digital tools can support various aspects of Bloom's Taxonomy by identifying, interpreting, and categorizing information. For example, AI applications can simplify complex topics into manageable, descriptive multimedia messages, enhancing student comprehension and retention.
2. **Method Selection and Contextual Application:** Bloom's revised framework emphasizes selecting methods appropriate to the context. AI in digital learning can dynamically suggest strategies based on students' cognitive levels and learning styles, particularly aiding in the "apply" stage. This adaptability ensures that students gain knowledge and can effectively apply it in diverse scenarios.
3. **Decomposition and Analyzing Interrelationships:** At the analysis stage, AI platforms enable students to decompose complex concepts and explore interrelationships, fostering a more profound understanding. AI-guided analysis supports critically examining how individual components contribute to an overall subject.
4. **Establishing Standards and Evaluative Criteria**: Evaluation requires clear standards and criteria. In digital contexts, AI can assist educators in setting consistent rubrics and benchmarks for evaluating student work, making assessment processes transparent and measurable.
5. **Facilitating Innovation and Simplification:** The "create" stage encourages innovation. AI tools like simulations and design software enable students to simplify, innovate, and refine their ideas, reaching higher cognitive levels of Bloom's Taxonomy.

AI platforms facilitate self-assessment, goal-setting, and progress monitoring through metacognitive support, allowing students to personalize and effectively self-regulate their learning journey. Integrating cognitive and metacognitive skills creates a comprehensive, efficient digital learning experience.

Figure-3: : Revised Bloom Taxonom



Source:https://elearningbunch.wordpress.com/2013/02/20/revised-bloom-taxonomy/

Implementation and Impact in Digital Learning: Educators can utilize the updated taxonomy in digital and AI-enhanced settings to create curricula that correspond with defined objectives, evaluate learning outcomes, and establish a cohesive strategy for teaching, learning, and assessment. As digital learning increasingly influences educational institutions, the taxonomy in developing remote learning programs. AI tools facilitate adaptable and focused instruction across all cognitive tiers, ranging from fundamental comprehension to advanced creative reasoning (Friesen, 2005; Krathwohl & Anderson, 2010; Fisher, 2011).

Incorporating Bloom's updated taxonomy into AI-enhanced digital learning creates a structured and adaptable approach that aligns with modern educational demands. With digital tools effectively supporting each cognitive stage, educators and students can achieve meaningful learning outcomes in the dynamic and complex nature of knowledge in the 21st century.

Table-2: Bloom's Taxonomy cognitive and knowledge dimensions (Fisher, 2011)

Bloom's Taxonomy						
Knowledge Dimension	**Cognitive Process Dimension**					
	Remember	**Understand**	**Apply**	**Analyze**	**Evaluate**	**Create**
Factual Knowledge	List	Summarize	Classify	Order	Rank	Combine
Conceptual Knowledge	Describe	Interpret	Experiment	Explain	Assess	Plan
Procedural Knowledge	Tabulate	Predict	Calculate	Differentiate	Conclude	Compose
Meta- Cognitive Knowledge	Appropriate Use	Execute	Construct	Achieve	Action	Actualize

Improving Activity Success and Attaining Objectives: Efficient Strategies

Various techniques can enhance activity success, effectively achieve learning objectives, and draw on learners' existing background knowledge. These approaches are instrumental in reinforcing information, improving retention, and fostering a deeper understanding of the material in digital learning environments.

Integrating Revised Bloom's Taxonomy into AI-Driven Digital Learning Environments Aligning with Learning Frameworks

The Revised Bloom's Taxonomy (2001) provides a strategic framework for developing educational experiences in AI-integrated, digital, and online learning environments. This updated taxonomy enhances the conventional cognitive hierarchy to better align with modern digital platforms, where interactivity and adaptability are paramount. Methods include repetition and the timely use of the SOLO (Structure of Observed Learning) model, Fink's Taxonomy, the Outcome Taxonomy, and the PI Model. Each model facilitates the organization of learning activities to promote increasingly advanced cognitive processes and metacognitive involvement.

A Closer Look at Learning Models

Among these models, the provides a unique approach, progressing learners through levels of understanding from simple recognition to advanced abstract thinking. This model complements Bloom's approach by fostering progressive complexity in learning tasks. It encourages the design of learning paths that evolve from foundational knowledge acquisition to integration, analysis, and abstract application, thereby promoting deep, sustained learning. Such structure is precious in AI-assisted platforms that track and respond to learner progress in real time.

Incorporating Metacognitive Elements

The Revised Bloom's and Fink's Taxonomy emphasize introspective learning and metacognitive skills. Reflection and self-assessment help Fink's (2003) students interact more profoundly and independently with knowledge. Online forums and collaborative projects let learners contextualize and reflect on their learning. Shea et al. (2011) recommend categorizing online talks by cognitive difficulty using the SOLO framework. This classification helps students assess their progress and improve their learning methods.

The Cognitive Domain in Digital Contexts

The PI Model (Garrison et al., 2001) further supports cognitive development by focusing on knowledge-building within online communities. Schrire (2004) underscores its value over traditional frameworks like Bloom's and SOLO when analyzing cognitive processes in collaborative digital learning. The model's emphasis on knowledge construction and critical thinking is particularly relevant in AI-driven platforms that can adapt to and facilitate group learning.

Employing Digital Tools in Alignment with the Revised Bloom's Taxonomy

Rise AI and digital applications have transformed open and distance learning, offering tools that innovatively support the various stages of Bloom's Taxonomy. Each tool below contributes to specific cognitive levels, from knowledge recall to creation, making them well-suited for AI-enhanced learning environments:

1. **Blogger**– Through content analysis and discussion, Blogger fosters critical thinking and knowledge synthesis as students interact with peers and instructors.
2. **Edu-Creations**– This interactive whiteboard and screen-casting tool leverages open video resources, supporting the application and analysis stages by allowing users to create and share instructional content

3. **Zoho Docs**– Providing extensive document collaboration and offline storage, Zoho Docs enables students to share and refine ideas collectively, supporting the application and synthesis stages of learning.
4. **Inspiration Maps™**- This adaptable visual tool helps organize ideas and promotes comprehension, analysis, and higher-order thinking skills.
5. **Skype**– Facilitating real-time discussions across multiple devices, Skype supports analysis and synthesis as learners collaborate and discuss in virtual environments.
6. **Edumodo**– Integrating with learning management systems, Edumodo allows students to participate in discussions and share resources, enabling the reinforcement and extension of their learning.
7. **Splice–** With unrestricted video editing capabilities, Splice encourages creativity and application, enabling students to produce original video content without constraints.
8. **Vid Trim**– An Android-based video editor, Vid Trim facilitates knowledge application and sharing by allowing learners to edit and share video projects effectively.
9. **Wufoo** – This form-building platform enhances information gathering and analysis, supporting higher-order skills as students create forms and surveys for data collection and project organization.

Table-3: Emerging technologies and instructional software to support the revised Bloom Taxonomy

Revised Blooms Taxonomy Sub-dominies	Emerging technologies and instructional software
Create	Splice, VidTri, MindMeister, MindMaple, Podomatic, Kids Story Builder, Youtube, ZooBurst
Evaluate	Skype, Edmodo, Debate Timer, Watsapp, Picasa, Blogger, Layar, Google +
Analise	Inspiration MapsTM, Wufoo, Code Writer, Zoho Creator, Mentimeter, Wikitude
Apply	Educreations, Zoho Docs, SoloLearn, Ustrea, Adobe Connect, Google Drive, OneNote, Dropbox, Scribble
Understand	Twitter, Tumblr, Instagram, Evernote Touch, Anatomy 4D
Remember	Tureng, Google, Bing, Delicious, Diigo, WPS Office, Junaio

10. **Integration with Digital Tools**: Leveraging advanced AI-powered tools and digital learning technologies to align with cognitive domains. Specific strategies are outlined for embedding digital resources, such as interactive quizzes and AI-driven analytics, within the taxonomy framework to enhance student engagement and knowledge retention (Nehru et al., 2023).

Strategically integrating these technologies inside an AI-supported framework fosters student engagement across all cognitive levels defined in Bloom's Revised Taxonomy, from fundamental recall to innovative output. As educational technology advances, integrating these digital tools with established frameworks such as Bloom's

taxonomy and the SOLO model will improve online learning experiences, resulting in more effective attainment of educational goals.

Employing Revised Bloom's Taxonomy: Digital Classroom Engagements

The Revised lets students actively use digital tools and apps to enhance learning outcomes. The path from foundational infor mation to advanced critical thinking skills is regulated when teachers and students choose resources based on educational goals rather than tools. The fundamental goal of this taxonomy is to help pupils navigate cognitive levels.

The following table outlines digital activities aligned with each level of demonstrating how these can be applied effectively within online and AI-supported learning platforms:

Table 4: Engagement Strategies for the Digital Classroom

Level	Description	Digital Activity
Creative	Synthesize past knowledge to create new products	Students initiate and develop a project based on curriculum topics, producing digital content such as presentations or videos.
Evaluation	Apply criteria-based judgments	Students evaluate and respond to comments on a blog post, promoting critical feedback and reflection (e.g., Blogspot).
Analysis	Determine relationships between parts and the whole	Use online survey tools to gather and interpret data, exploring how elements connect (e.g., SurveyMonkey).
Application	Apply knowledge to practical situations	Edit content on a wiki platform, allowing students to contribute to knowledge bases (e.g., Wikipedia).
Understanding	Construct meaning and build relationships	Create and tag bookmarks on social platforms, fostering collaborative learning (e.g., Pocket).
Remembering	Retrieve information and resources	Identify legitimate search engines, enhancing resource literacy and retrieval skills (e.g., Google).

Strategic Implications for Digital and Online Learning Environments

Aligns with essential support systems and enhances collaborative, interactive environments. Research shows that structured digital platforms improve learning flow and enrich educational outcomes (Cole & Stanton, 2003; Ryu & Parsons, 2009). This ApproachApproach addresses contemporary pedagogical demands by using AI and digital resources, fostering adaptive, cognitive, and digital skills development.

Digital tools facilitate interactive learning experiences tailored to educational objectives. Establishes a framework of objectives that fosters 21st-century abilities like analysis, creativity, and problem-solving (Fisher, 2011; Yen et al., 2012). Mobile applications interact effortlessly across educational platforms, promoting varied and inclusive learning possibilities.

Emerging technology trends underscore collaboration between educators and developers to expand global access to high-quality resources through tools like social media and online courses (Ozan et al., 2015). Policy initiatives, including those in India, emphasize framework can guide effective design (Arshavskiy, 2016).

Ultimately, integrating digital tools and educational philosophies enriches learning experiences, blending traditional and digital pedagogy to prepare students for a better digital world.

Revised Bloom's Taxonomy vs. AI: Learning Environment Effects

AI-enhanced to developing a deeper understanding of learning beyond rote memorization, prioritizing critical thinking as a vital component. With its cognitive framework—"remembering, understanding, applying, analyzing, evaluating, and creating"—the groundwork for designing assessments and structuring curricula that encourage progressive levels of thinking. This hierarchy reflects increasingly complex information processes, offering an ideal structure for embedding higher-order thinking (HOT) models that educators can employ to elevate learning.

Integrating AI to Enrich Bloom's Cognitive Spectrum

Artificial intelligence revolutionizes the learning experience by shifting focus from static content delivery to dynamic, learner-centered engagement. AI-enhanced environments support adaptive, personalized learning paths that empower students to pursue self-actualization, making education not just a process but a transformative experience. AI tools serve as primary conduits for continuous data flow, helping teachers (or "mentors") provide insightful, real-time feedback that is supportive rather than corrective. This feedback loop fosters growth without traditional assessment pressures, creating an environment conducive to cognitive and emotional development.

Cognitive Engagement in AI-Driven Learning

AI bolsters cognitive growth through the Revised Bloom's Taxonomy by creating intellectually supportive environments where students learn and explore without overwhelming stress. Techniques such as adaptive testing, which tailors assessment difficulty based on the student's response patterns, and problem-solving tasks requiring critical assessment align with Bloom's cognitive goals. Additionally, AI tools enable collaborative interaction, real-time feedback, and iterative improvement—strengthening memory retention and conceptual understanding. The synergy between AI and Revised Bloom's Taxonomy activates neural pathways reinforcing deep learning and comprehension.

Challenges and Ethical Considerations in AI-Based Learning

While AI dramatically enhances educational environments, it also introduces unique challenges. Issues such as algorithmic biases, digital addiction, and lacking humanized engagement can create barriers to effective learning. Educators strategically counter these challenges by embedding critical thinking, creativity, and socio-emotional skills alongside technological competencies. By doing so, they ensure that AI is an aid rather than a replacement for humanistic learning, fostering a balanced approach that prepares students for complex digital interactions without sacrificing empathy or ethical judgment.

Enhancing Cognitive Engagement through Taxonomy in Online Settings

Integrating Bloom's taxonomy into

educational strategies enhances cognitive engagement and fosters personalized learning by leveraging digital tools aligned with various cognitive levels. Revised Bloom's taxonomy emphasizes higher-order thinking skills such as analyzing, evaluating, and creating, which are critical in online education (Anderson et al., 2001; Amer, 2006). Interactive activities designed with taxonomy frameworks can significantly deepen understanding (Akyol et al., 2009; Hui, 2024). Digital tools, including adaptive AI platforms and gamified learning environments, effectively support these objectives by scaffolding tasks to meet individual learner needs (Fink, 2003; Lai et al., 2007).

Aligning Digital Tools with Taxonomy Levels

Mobile technologies further facilitate experiential learning, enabling learners to engage in authentic, context-driven activities that promote cognitive progression (Criollo-C et al., 2021; Herrington et al., 2009). Frameworks like SOLO also complement Bloom's taxonomy by emphasizing competence progression in curriculum design (Brabrand & Dahl, 2009). These methods align with research advocating for self-directed, significant learning experiences (Frohberg et al., 2009; Nehru et al., 2020).

Bridging Personalized Learning Gaps Using Digital Frameworks

Customized, taxonomy-based digital frameworks can address gaps in personalized learning, fostering tailored educational experiences that align with cognitive and developmental needs (Krathwohl, 2002; Shea et al., 2011). For instance, mobile learning platforms utilizing Bloom's principles have demonstrated measurable improvements in learning outcomes, particularly in STEM disciplines (Papadakis et al., 2021; Kuo et al., 2011). Combining these strategies with effective teaching practices ensures an inclusive, progressive educational environment (Anderson, 2005; Iowa State University, n.d.).

Conclusion

In conjunction with AI and digital learning systems, it provides a powerful model for achieving educational objectives that align with 21st-century skills. This integration promotes cognitive development across Bloom's levels and supports learners in achieving durable, meaningful learning outcomes. AI-driven education can cultivate well-rounded individuals prepared to navigate and thrive in the digital age by incorporating critical thinking, creativity, and problem-solving skills.

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Research Article

Understanding the potential of Augmented Reality to improve Mathematical Education

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Abstract

Since Augmented Reality (AR) has the potential to completely transform conventional teaching methods, it is highly significant in the field of mathematics education. Its ability to enhance visualization by providing dynamic and interactive representations of complex mathematical ideas is one of its main advantages. The purpose of the study is to evaluate their awareness and attitude toward the use of AR in math education. The study employed the descriptive survey method. 122 upper primary mathematics teachers from the Coimbatore district are the subjects of the current study. There were 66 female and 56 male math teachers in the study sample. Therefore, based on mean scores, there is no discernible difference in the Awareness score between gender, years of experience, and educational attainment. While there is no discernible difference in years of experience or educational attainment, there is a significant gender difference when looking at the Attitude score. The study's conclusions point to a possible paradigm change in instructional strategies as AR becomes a game-changing tool for improving student learning. Additionally, the study suggests that curriculum modifications are necessary to smoothly integrate AR and bring instructional materials into line with the quickly changing technology environment.

Keywords: Augmented Reality, Mathematics Education, school teachers, Awareness and Attitude

Introduction

Mathematics is a crucial tool in everyday life, influencing our activities and decisions (Manjunath, 2021). It is essential for problem-solving, creativity, and critical thinking, and is used in various fields, including science, engineering, and economics (Peter, 2011). Mathematical literacy, which includes competencies such as mathematical thinking and reasoning, is a key skill for navigating the complexities of the 21st century (Rizki, 2019). Despite its importance, many students struggle to see the real-life applications of mathematics, and it is often perceived as a dry and irrelevant subject (Manjunath,2021). The fundamental mathematical operations—addition, subtraction, multiplication, division, and certain geometrical shapes—have a great deal of application in everyday life (Devlin, 2005). The development of mathematical knowledge and abilities in schools depends on the methodical and efficient teaching of mathematics (Târnoveanu, 2017) . This involves using various teaching methods tailored to the learning abilities of students (Yanushkevichiene, 2016). Since mathematics is crucial for both academic performance and problem-solving, it is

necessary to foster a favorable attitude toward it (Târnoveanu, 2017).

Attitudes, as defined by Zanna and Rempel (1988), are complex psychological constructs influenced by affect, cognition, and individual differences (Haddock, 1993). This inclusive definition, proposed by Eagly (2007). Maio (2013) emphasizes the evaluative nature of attitudes and their role in shaping behaviour. Further explores the link between attitudes and behaviour, highlighting their unique psychological content, structure, and function. However, Wicker (1969) raises a critical question about the relationship between attitudes and behaviour, suggesting that the two may not always align. It involves a combination of cognitive, affective, and behavioural components that shape how individuals perceive and respond to the world around them (Eagly,et al., 1993). This study examines attitudes toward the use of augmented reality (AR) in math instruction, both favourable and negative.It influences a teacher's behaviour or utilizing AR in teaching Mathematics favourably or unfavourably. The condition of knowing something is called awareness by (Baars, B. J.1997). According to the current study, awareness is the condition of being educated about integrating the use of augmented reality into math instruction. AR is a technology that allows users to interact with virtual objects superimposed on real-time visuals (Azuma R 1997 & 1999). Augmented reality (AR) overlays digital information on real-time photographs to create an interactive and dynamic environment (Milgram et al., 2013).

Augmented Reality (AR) provides a platform for teaching abstract concepts that are hard to visualize mentally, as suggested by (Kaufmann 2003) ; (Núñez et al., 2008); (Shelton et al., 2002), and (Wu et al., 2013). AR leverages multimedia elements like texts, pictures, audio, and video, along with 3D models (Shelton et al., 2002), to enhance the learning experience. Some of the studies conducted in teaching Mathematics of Geometric objects (İbili ,2013) , Prisms (Tosik Gün, et al., 2017) Geometric objects (İbili et al.,2013) & (Tosik Gün, et al., 2017) using AR.

Need and Significance of the Study

Any child has to learn mathematics to be able to use their skills and knowledge in a variety of contexts. Mathematical qualification plays a significant role in the curriculum as it is one of the defining features of scientific culture (Kothari Commission, 1986).

Developing logical and problem-solving abilities among children is the major objective of teaching Mathematics as the development of children's ability for Mathematization i.e. students' thought processes must be mathematized (NCF, 2005). The study of mathematics enhances one's capacity to solve problems and think critically, creatively, and logically, which has an enormous impact on every day life(Sharma, 2021; Dahiya, 2014). These are adaptable talents that are essential in a variety of fields (Evans, 2000).

Mathematics is not only relevant in the workplace but also in daily life, where it is used in a wide range of activities (Yeo, 2010). In this sense, mathematics is one of the basic disciplines taught in schools, and many pedagogical approaches are used to raise students' mathematical success levels. (Gervasoni, 2008) emphasizes the need for successful mathematics pedagogy, while (Chen, 2020) focuses on the integration of subject knowledge and information technology in high school mathematics education. (Pokharel, 2020) highlights the importance of innovative activities, worksheets, and teaching aids in making mathematics learning joyful and effective. (Chaman,

2014) underscores the significance of mathematical knowledge and competence in secondary school education. Despite having implemented various teaching strategies to teach Mathematics, the slow learners couldn't achieve the expected attainment. This is because the learners couldn't imagine their concepts. In this regard, slow learners find it difficult to make use of their abstract thinking. Slow learners often struggle with abstract thinking in mathematics, particularly in areas such as reflective abstraction, mathematical reasoning, and problem-solving strategies (Wafiqoh, 2022). To address this, specific measures and methods to cultivate their abstract thought ability. In the context of writing, slow learners face challenges in narrative text due to their limited abstract thinking (Husain, 2020). This is further compounded by difficulties in understanding mathematical concepts and performing arithmetic operations (Metikasari, 2019). To overcome these challenges, it is important to provide clear conceptions and use teaching aids to help slow learners understand and apply abstract concepts.

Generally, the Mathematics teachers stick with the chalk-and-talk method in which most of the mathematical problems are written on a Blackboard and explain the concepts orally by the teacher. To modify the teaching strategy and enhance the professionalism among the teachers by using Augmented Reality in teaching Mathematics. How for the Mathematics teacher have wider knowledge about Augmented Reality and to what extent does their attitude in utilizing Augmented Reality in teaching Mathematics?

Review of literature

It has been shown that integrating augmented reality (AR) into mathematics instruction promotes pupil understanding and engagement with the material. The potential of AR to increase motivation and comprehension, which will result in a deeper comprehension of concepts in mathematics, is being highlighted by (Buentello-Montoya, 2021) and (Coimbra, 2015) . The use of augmented reality (AR) to visualize mathematical objects and create a more relevant learning environment is discussed in (Yingprayoon, 2015) and (Carvalho, 2014), which lends greater weight to this. The considerable potential of augmented reality in mathematics teaching is highlighted in the literature research. Because it encourages motivation, collaboration, and real-world relevance, Augmented Reality (AR) has the potential to substantially enhance the mathematics learning experience (Coimbra, 2015; Kazanidis, 2019; Chao, 2018). It can promote a deeper comprehension of mathematical ideas, resulting in the absorption of information and the growth of persistent competencies (Coimbra, 2015).Enhancing learning results, augmented reality apps can also offer clear learning situations and more participatory encounters (Kazanidis, 2019). Moreover, AR has the potential to improve students' comprehension of mathematical ideas, especially when it comes to volume and 3D composition (Chao, 2018). The technology's capacity to combine the real and virtual worlds can help students grasp abstract ideas, enable embodied representations of mathematical ideas, and foster collaborative learning (Bujak et al., 2013). The use of AR in mathematics education presents both benefits—such as improved learning and motivation—and challenges—such as technical issues and resistance to new technology (Palancı, 2021). Despite these difficulties, AR and Virtual Reality (VR) technologies have been found to have potential benefits in mathematics learning, particularly in the areas of socio-emotional, cognitive/

meta-cognitive, and pedagogical development (Cevikbas, 2023). Teachers face difficulties in creating AR-assisted learning media, including conforming to hardware and software standards and gaining access to pertinent resources.

Statement of the Problem

Integrating Augmented Reality is the modern trend in teaching core subjects in schools for the academic excellence of the students as well as to enhance the professionalism of teachers. It is anticipated that all educators possess a strong attitude and awareness when it comes to using augmented reality in the teaching of mathematics. If so what extent is their Attitude and Awareness in integrating AR in teaching Mathematics? Hence the study is carried out by the researcher entitled "The Role of Augmented Reality in Enhancing Mathematics Education: A Study on Awareness and Attitude".

Objectives of the Study

To determine if the use of Augmented Reality (AR) in math instruction by upper primary teachers is significantly impacted by factors such as gender, years of experience, and educational background.

Research Questions

Do upper primary Mathematics teachers exhibit differences in their attitude and awareness of the integration of augmented reality in Mathematics instruction based on gender, educational qualifications, and years of experience?

Method

Research design: The study followed the descriptive survey approach. A descriptive survey design is a widely used method in research, particularly in social sciences, to describe characteristics of a population or phenomenon being studied. In this design, the researcher collects data without manipulating the environment. The goal is to gather quantifiable information to describe patterns, trends, or phenomena.

Population and Sample: The study's population consists of upper primary mathematics teachers in the Coimbatore area. The samples for the research were selected using a cluster sampling method. This method involves dividing the population into clusters (which could be based on schools or geographic areas), and then randomly selecting clusters for inclusion in the sample.56 male and 66 female teachers of mathematics from the Coimbatore district made up the samples. The study's sample includes 122 upper primary mathematics teachers in total.

Design and development of tools of study

Questionnaire: To evaluate Awareness and Attitude toward Augmented Reality in integrated mathematics instruction, the researcher has examined several earlier studies. It was discovered that no tools were accessible to measure Attitude and Awareness scales related to the incorporation of augmented reality in mathematics education. As a result, the researcher created two original instruments for the investigation.

- Attitude towards integrating Augmented Reality in teaching.
- Awareness of integrated Augmented Reality in teaching Mathematics

The researcher reviewed several literates and discussed with the subject experts the selection of items for the tools. The items of the two tools are arranged separately for Attitude and Awareness in integrating AR in teaching Mathematics. After drafting the English version of the items, the

same was translated into Tamil for easy understanding of the AR in integrated Mathematics teaching.

In the initial development of the tools for measuring Attitude and Awareness regarding the integration of Augmented Reality (AR) in teaching mathematics, a total of 43 items were selected for the attitude scale and 36 items for the awareness scale. These tools were designed to assess teachers' perspectives on AR and its application in mathematics education. Subject experts who are directly involved in mathematics teaching and have ICT experience at both school and college levels were consulted to review the tools. The experts were requested to provide their opinions and suggestions on various aspects, including the language, simplicity, relevance, and validity of the items in both tools.

Based on the feedback from the subject experts, the researcher made necessary modifications to improve the clarity and appropriateness of the statements. This process ensured that the tools were not only easy to understand but also aligned with the study's objectives. Both tools included closed-ended questions to systematically assess the participants' knowledge of AR and its practical application in integrating AR with mathematics teaching. These revisions helped ensure that the tools were valid measures of the teachers' attitudes and awareness regarding AR integration in mathematics classrooms.

Validity: The content validity of 2 tools was established in consulting with a team of 5 subject experts in the field of Mathematics who have experience in utilizing ICT teaching. They have analyzed the appropriateness of the items for the assessment.

Reliability: Thirty upper primary school teachers who were not engaged in the study were given the two tools as a sample. To test the consistency between the two sets, every item in each of the two tools is split into two equal halves at random. The Split-Half Method was employed by the researcher to determine the two tools' reliability. The study employed the alpha approach to determine each tool's internal consistency independently. The researcher rejects items in the two tools with alpha values less than 0.25 and larger than 0.80. There are 35 items in the attitude toward integrated augmented reliability in mathematics education scale, which is the last instrument.

The Pearson- Correlation was found for Attitude towards integrating AR in teaching Mathematics to be 0.89, and Awareness of integration of AR in teaching Mathematics was found to be 0.87. This indicates consistency between two sets with high reliability.

Scoring Procedure: The Attitude towards Augmented Reality in Teaching Mathematics Scale has a 5-point Likert type, with positive statements scoring 5 points and negative statements scoring 5 points. The Awareness of Augmented Reality in Teaching Mathematics Scale has a 3-point Likert scale, with no negative statements. The maximum score is 60, and the minimum is 0.

Results and Discussion

Do the upper primary Mathematics teachers differ in their Attitude and Awareness in integrating Augmented Reality in teaching Mathematics concerning their Gender, Educational qualifications and years of experience?

For testing the research question, the following results were found by the investigator.

Table-1: Attitude and Awareness result based on Gender

	Variable	N	Mean	S.D.	Levene's Test		t-test for Equality of Means		
					F	Sig.	t	Sig.	Result
Awareness score	Male	56	34.61	14.481	0.055	0.815	-0.488	0.626	NS
	Female	66	35.89	14.531					
Attitude score	Male	56	133.07	12.090	15.433	0	23.709	0	S
	Female	66	57.89	22.165					

Awareness Score: According to Levene's test, the equal variances assumption between the groups is confirmed with non-significant findings ($p = 0.815$). The null hypothesis cannot be rejected since there appears to be no discernible difference in Awareness scores, according to the t-test ($t = -0.488$, $p = 0.626$). As a result, there is no statistically significant difference between the two groups' mean Awareness ratings.

Attitude Score: For Attitude scores, Levene's test finds a violation of the equal variances assumption ($p < 0.001$). There is a considerable difference in the mean Attitude scores between the two groups, as indicated by the very significant p-value (0, almost zero) of the subsequent t-test that takes uneven variances into account. These results support the notion of uneven variances.

Table -2 : Attitude and Awareness result based on Educational status

	Variable	N	Mean	S.D.	Levene's Test		t-test for Equality of Means		
					F	Sig.	t	Sig.	Result
Awareness score	UG & B.Ed	73	36.01	14.709	0.059	0.808	0.666	0.507	NS
	PG B.Ed	49	34.24	14.171					
Attitude score	UG & B.Ed	73	88.63	42.128	0.000	0.983	-1.226	0.223	NS
	PG B.Ed	49	98.02	41.034					

Awareness Score: For equal variances assumed ($p = 0.808$) and not assumed ($p = 0.507$), both surpassing the 0.05 significance threshold, non-significant findings are shown by Levene's test for Awareness scores. This implies that both possibilities satisfy the premise of equal variances. When equal variances are not assumed, the t-test, taking uneven variances into account, confirms a non-significant p-value (0.507), showing no discernible difference in the mean Awareness ratings between the two groups.

Attitude Score: A substantial breach of the equal variances assumption is found using Levene's test for Attitude scores, with p-values for equal variances assumed and not assumed being 0.000 and 0.223, respectively. Even yet, the t-test with unequal variances

assumption produces a non-significant p-value of 0.223, meaning that, when all other factors are held constant, there is no discernible difference in the mean Attitude scores between the two groups.

Table-3: Attitude and Awareness result based on teaching experience

	Variable	N	Mean	S.D.	Levene's Test		t-test for Equality of Means		
					F	Sig.	t	Sig.	Result
Awareness score	< 10 Yrs	73	35.23	15.265	3.449	0.066	-0.067	0.947	NS
	> 10 Yrs	49	35.41	13.331					
Attitude score	< 10 Yrs	73	93.93	40.660	0.509	0.477	0.485	0.629	NS
	> 10 Yrs	49	90.12	43.717					

Awareness Score: Levene's test for Awareness scores gives p-values of 0.066 and 0.947 for equal and unequal variance assumptions, respectively, both beyond the 0.05 significance threshold. This implies that both possibilities satisfy the premise of equal variances. The fulfilled assumption is supported by the t-test with unequal variances assumption, which confirms a non-significant p-value (0.947) showing no significant difference in mean Awareness scores between the two groups when equal variances are not expected.

Attitude Score: For equal and unequal variance assumptions, respectively, Levene's test for Attitude scores produces non-significant p-values of 0.477 and 0.629, both of which surpass 0.05. This implies that both possibilities satisfy the premise of equal variances. The t-test with unequal variances assumption confirms that there is no significant difference, as evidenced by the non-significant p-value (0.629).

Findings of the study

- The mean scores for the Awareness score do not significantly differ between the two groups (Al-Enezi, 2018). On the other hand, the assumption of equal variances is broken for the Attitude score, where the mean scores for the two gender groups diverge significantly (Dirin 2019).
- Whether or not the premise of equal variances is satisfied, there is no discernible difference in the mean scores for the Awareness and Attitude scores between the two groups of educational status. Furthermore, regardless of whether the premise of equal variances is satisfied or not, there is no discernible difference in the mean scores for the Awareness and Attitude scores between the two groups of years of experience.

Implication of the study

It is simpler to incorporate current technology into the teaching of mathematics when teachers have a positive attitude and are highly informed of how to integrate augmented reality into their lessons. They can also increase professionalism, improve student academic accomplishment, and employ modern technology more effectively. It has been demonstrated that using augmented reality (AR) into mathematics instruction improves student engagement and learning results. The depiction of 3D geometrical objects made possible by AR can help

students comprehend and remember mathematical ideas (Yingprayoon, 2015). Additionally, it promotes understanding, motivation, and a greater level of engagement with the material (Coimbra, 2015). Meaningful learning can result from the use of augmented reality (AR) in mathematics instruction, which can foster a more engaging and dynamic learning environment (Carvalho, 2014). Additionally, the use of AR technology in STEM-based mathematics education holds great promise (Kramarenko, 2019). AR can improve critical thinking skills, spatial reasoning, and problem-solving abilities (Anggraini, 2020). It can also enhance learning motivation and confidence (Young, 2016), and foster spatial ability in middle school students (Ozcakir, 2021). Furthermore, AR can provide a better understanding of geometrical structures and improve learning abilities in mathematics (Yingprayoon, 2015).

Recommendation of the study

Based on the findings of the study, it is recommended that a high level of Awareness and positive Attitude in integrating Augmented Reality in teaching Mathematics are necessary to implement in the Teacher Education Curriculum for B.Ed trainees. So that prospective teachers could learn Augmented Reality and its effectiveness for the enhancement not only in Mathematics but also in other subjects. Secondly, the Nodal agency in the Department of School Education SCERT and RMSA must impart In-service training programs to the Mathematics teachers. At all the levels of the School, a system should be created to implement Augmented Reality in teaching Mathematics with proper infrastructure. The students also encouraged that the teacher must emphasize the integration of Augmented Reality in teaching Mathematics with respect to Gender, Educational Qualification and Years of Experience.

Conclusion

However, it is essential to be aware of potential challenges and limitations when implementing AR in mathematics education. These may include the cost and availability of AR devices, the need for proper teacher training, and ensuring that AR applications align with curriculum objectives. In general, greater learning results, more student engagement, and better readiness for the digital age can result from awareness of and favourable attitudes toward augmented reality in mathematics education. By embracing AR technology responsibly and effectively, educators can create a more inclusive, interactive, and dynamic learning environment for students.

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Research Article

In their Own Words: Exploring Students' Perspective on Accessing Assistive Technologies in a Blind School

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Abstract

Assistive technologies are pivotal in enhancing the daily lives of students with visual impairments (SVIs), facilitating activities such as orientation, mobility, reading, writing, and exploring their surroundings. This study adopts a qualitative case study approach to investigate the availability of assistive technologies at a blind school in Delhi and understand the perspective of SVIs towards accessing these technologies. Participants in the study include middle school students aged 12-18 years. Primary data is gathered through observations, unstructured interviews, and conversations, complemented by secondary data from relevant literature. The data is analyzed thematically by categorizing it using an iterative reflective process. The results indicate a prevalence of traditional assistive technologies in schools, including Braille Slate, Stylus, Braille Books, and Taylor Frame for Arithmetic. Students exhibit a preference for these traditional tools, finding them more comfortable. Nevertheless, smartphones are concurrently utilized to stimulate academic and leisure interests. The study highlights the limited reach of various assistive technologies at the grassroots level. Students' engagement with traditional assistive technologies and smartphones for learning introduces an intersubjective dimension, rendering them more preferable to alternative options

Keywords: Assistive technologies, accessibility, students with visual impairment, smartphones, blind school

Introduction

Nearly one in three students with disabilities in India has a visual impairment (29 per cent), as reported by the Eighth All India School Education Survey (NCERT, 2016). To support the daily living and education of SVIs, the Rights of Persons with Disabilities Act, 2016 (RPWD Act, 2016) and National Education Policy 2020 (NEP, 2020) ensure assistive devices, appropriate technological tools, and language-appropriate teaching-learning material such as Braille and large print for SVIs. Moreover, various governmental entities, including the National Council for Educational Research and Training (NCERT), the National Institute for the Empowerment of Persons with Visual Disabilities (NIEPVD), and the Artificial Limbs Manufacturing Corporation of India (ALIMCO), are dedicated to enhancing accessibility to education and improving the quality of life for individuals with visual impairments. This commitment is manifested through the development and manufacture of assistive technologies and devices tailored to the specific needs of SVIs. In this direction, one such initiative has been taken in the form of Assistance to Disabled Persons for Purchase/Fitting of Aids and Appliances (ADIP Scheme). For approximately three decades, this scheme has been a cornerstone in operationalizing policy initiatives concerning assistive technologies

for persons with disabilities (PwDs). Focused on facilitating physical, social, and psychological rehabilitation, the scheme empowers PwDs by providing essential aids and appliances. In 2020 alone, twenty-one dedicated ADIP camps were held nationwide, effectively distributing crucial assistive resources.

Available Assistive Technologies for SVIs

The World Health Organization (WHO) frames assistive technology as a comprehensive system encompassing devices and services that empower individuals with disabilities to function independently within their environment. This definition expands beyond tools to encompass the infrastructure and support necessary for effective utilization. As Ravneberg and Söderström (2017) emphasize, assistive technologies not only simplify daily tasks for persons with disabilities but also facilitate their active participation in social life, aligning with the principles of universal design. Advancements in technology have driven the evolution of these tools, leading to a diverse array of solutions applicable across various aspects of daily living, from mobility and education to sports and leisure. Furthermore, Laconsay et al. (2021) argued that the incorporation of technology in (chemistry) education benefits not only the SVIs but also the sighted students. In the Indian context, various assistive technologies are available, developed, and distributed through the above-mentioned government entities and schemes. Some of the assistive technologies available in India (Department of Empowerment of Persons with Disabilities (Divyangjan), Ministry of Social Justice and Empowerment, Government of India, 2014; SakTek, n.d.) are described below:

Orientation and Mobility

For orientation and mobility, various canes are available for SVIs. There are white canes, including rigid long canes and foldable canes, that help detect the obstacles in the way. There are smart canes which are foldable and come with detachable sensors. These ultrasonic sensor units inform the user about the potential obstacles with the help of vibrations. Also, various spectacles are available for persons with low vision, which help with orientation and mobility.

Educational kits and devices

1. **Reading and Writing-** For assistance in reading, a wide range of devices and software are available according to the needs of SVIs. There are devices and software like handheld magnifiers and magnifying software for low-vision students. The other available assistive technologies for reading are Audiobooks, Daisy Player, and Victor Reader (used for listening to audio files and text files through read-aloud options and recording lectures). Similarly, the Refreshable Braille Displays are used as an alternative to standard computer monitors to help SVIs read output text. Also, there is a variety of built-in software with screen reading features in computers, tablets, laptops, and smartphones, which help navigate these devices and read different document file formats. Such software includes Job Access with Speech (JAWS), Non-Visual Desktop Access (NVDA), TalkBack, and Google Text to Speech.

   For assistance in writing, the Braille Slate and Stylus are traditional equipment that comes in two varieties: interline and interpoint. Various voice typing software is built

into computers and smartphones, and devices like Braillers and Orbit Writer (Braille Keyboard for Computers and Smartphones) are also available.

2. **Mathematics-** The available assistive technologies for mathematics learning are the Taylor Frame and cubarithm, which are used for mathematical calculations of arithmetic and algebra. Also, an Abacus with Braille markings is available for mathematical calculations. There is a geometric board with accessories such as a serrated scale, spring divider, Braille Protector with serrated arms fitted, Aluminum Spoon, Braille Quarter Protector, serrated Circle, and Foot Ruler. Additionally, for the measurement, the measuring tape with inch and centimetre markings stapled with pins was used for tactile cues.
3. **Science and Social Science-** To assist SVIs in science, tactile diagrams are embossed on the plastic cards. Also, for social science, there is a tactile globe and tactile drawing books for various monuments.

Games and Sports- For playing purposes, many sports equipment are modified to make them accessible to SVIs. These include an Audible Cricket Ball, Braille Playing Cards, a Chess Board, a Draught Board with plastic coins, a Tactile Snake and Ladders with Dice, Ludo with Dice and Dice Plate, a Scrabble board with plastic coins, a Puzzle, and an Audible Football.

Daily Living- To assist the SVIs in their daily living, some of the assistive technologies are Smart Phone with accessibility features, Talking and Tactile Watch, Large Print Watches, Talking Pulse Oximeter, Talking Blood Pressure Monitors, Talking Thermometer, Talking Calculator, Tactile Medicine Pill Box/ Dispenser, Plastic Measuring Jugs and Beaker, Measuring Cups and Spoon, Liquid level Indicator with Sound and Vibration Feedback, Signature Guide, Bumpons (labeling devices).

Many studies (Senjam et al., 2022; Ghai et al., 2022; Bhatt & Kumari, 2015; Murphy & Darrah, 2015; Tagore, n.d.) have found the critical role of assistive technologies and devices in supporting the education of SVIs in school. These studies report the various devices and technologies and how the SVIs can utilize them. The assistive technologies are based on other sensory stimulations, such as haptic and aural stimulations, to help SVIs learn by touch and auditory means (Jones et al., 2006). Nevertheless, the investigation needed to see the reach of these assistive technologies at the grassroots level. The following research questions help to take the inquiry further.

Research Questions

- What assistive technologies are available to students with visual impairment in a blind school in Delhi?
- How is the accessibility of assistive technologies perceived by the students with visual impairment enrolled in a blind school in Delhi?

Methodology

Research Design

The study employs a qualitative single case study research design. Baxter & Jack (2010) explain that "qualitative case study is an approach to research that facilitates exploration of a phenomenon within its context using a variety of data sources" (p. 544). Here, the case of the present research is a group of 15 SVIs studying in middle school, and two staff from the administrative office are sharing their perspective

about accessing assistive technologies. Keeping in mind the nature of the study, the researcher employed a purposive sampling technique.

Tools and Data Analysis

The research tools employed in this research design are observations, unstructured interviews, and conversations. All these tools are used to get deeper insights from the field and the participants. Secondary data is obtained by reviewing the existing literature in this field. As per the nature of the research design, the thematic analysis was done by reflecting on the transcribed data and giving codes to repeated words, phrases, and sentences. The themes were generated using the iterative analysis and coding process. As for the research ethics, the students and the school were informed about the research and permission to record data through field notes, audio recordings, and photos. Also, the participants' anonymity is maintained throughout the research writing process.

Field and Context of the Study

The study is situated in a residential special school for boys in a famous market area of Delhi. The school was a charitable blind school and a branch of one of the oldest blind schools in Delhi. This school was managed with the help of donations from people and aid granted by the government of Delhi. This school is an elementary school that provides a hostel and mess facilities as well. Books and uniforms are provided free of cost to all the students. Most children in this school come from neighbouring states such as Uttar Pradesh, Bihar, Haryana, and Rajasthan. A large number of students are from Bihar. The number of students in each class varies, and the number of students in upper primary classes is less than in primary classes. The participants are boys aged 12-18 years studying in upper primary classes. These students come from lower socioeconomic strata. The degree of visual impairment also varies as some students are totally blind, some have low vision and can see some colours and large prints, and some have a perception of light and shapes.

Result and Discussion

The analysis is based on observations and transcriptions of conversations with the students and staff of the school and unstructured interviews with students. The identification of the themes is done by providing codes to organize the data into categories with an iterative reflective process.

Availability of Assistive Technologies for SVIs in the School

The school is a charitable school run with the help of donations from affluent people and aid from the Government of Delhi. The school gets some assistive technologies in the form of donations and aids, as the secretary of the school said:

"We have some devices given by the government and non-government organizations. We have scanners that read books in an audio format and devices for recording and listening, but they are one or two devices and, therefore, not given for use. And we provide students with NCERT Braille books."

As the above statement highlights, except for traditional assistive technologies like Braille, the school has very few assistive devices available for reading, which are insufficient for all the students. Furthermore, it was observed that the only traditional assistive technology available in the school for assistance in writing is Braille Slate with stylus and Braille Sheet. Each student has their slate and stylus. Braille sheets

and books were always under their desks, and stacks of Braille books were organized in each classroom.

Similarly, observations reveal that each student has a Taylor frame with types used to teach arithmetic for assistance in mathematics.

It was also observed that no assistive technologies are available except Braille books for assistance in science and social science. As one of the students of class 7 said:

"We study science from books, and sir sometimes sends audio; we listen and make notes."

Students' primary learning in science (also in other subjects) happens through Braille books and lectures given by teachers in the classroom. Many studies (Senjam et al., 2022; Dey et al., 2018; Eligi & Mwantimwa, 2017; Bhatt & Kumari, 2015; Haider & Zaman, 2015)) also found a limited availability of assistive technologies specifically related to curricular areas like science and mathematics in schools.

Further, students inquired about the availability of assistive devices for playing; they were asked about the games they play. Student responses show that they play different games using assistive technologies such as audible cricket balls, chess, snakes, and ladders during and after school hours. As one of the students of class 6 said:

"Yes, we play cricket, snakes and ladders, and carrom...no, there is no carrom, but it will come soon, and we also sometimes race in sports, period. We enjoy it a lot while playing."

The other student in class 8 said:

"We play cricket, the cricket ball is different, it has a sound... Do you know there are small metal balls (chharre) used in the tire of a bicycle. These are inserted in a ball through a hole after that ball makes a sound. Also, we play chess and rassakashi (tug of war)."

The above excerpts highlight that students are aware about the features of the equipment used by them for playing and the other equipment which are going to be available soon.

Similarly, for orientation mobility and daily living, no assistive technologies were mentioned by students and have yet to be observed by the researcher as also reported by Senjam et al. (2022) that there is inadequate availability of walking canes in blind schools in Delhi. However, one of the students of class 8 mentioned:

"I had a walking stick earlier... yes, the smart cane, but I gave it to someone else, and he lost it somewhere."

One of the students from class 7 said:

"We usually do not go outside the school; therefore, we do not need canes to move...but when sometimes we go to another school, the school bus takes us there."

The other student said:

"We do not need any device for walking as we do not go anywhere, and when we have to go home, our parents take us with them".

However, students' responses reflect their limited perspective on the utilization of walking canes within the school periphery only, where they do not usually require it. Additionally, due to their familiarity with the school environment, students are less dependent on external assistance within the school premises. Ravneberg and Söderström (2017) argue that users abandon assistive technologies when there is no need for them. Notably, as observed, collaborative movements in pairs or groups are prevalent, particularly as a means of support for those with low vision assisting their peers who are entirely blind.

Assistive Technologies: As a part of rehabilitation

Students are aware of assistive technologies, and one of the community ophthalmic rehabilitation training teams from a renowned medical institution comes to train them to use these devices. This team comes for the weekly or monthly training and demonstration of assistive technologies for students. As one of the students of class 8 recalled:

"The team comes every week or two; they bring many devices, and let us know how to use them and ask for our feedback on these devices."

The researcher observed one such demonstration session; the team gathered a few students from classes 7 and 8 and helped them recall their previous sessions in which they demonstrated using devices like Daisy player and Victor Reader. They handed these devices to students and asked them questions about their functioning. Moreover, students agree that the team made them aware of devices like Daisy Player, Victor Reader, hand lenses, smart spectacles, and data-storing devices like Flash Drive. However, in post-rehabilitation training sessions, students do not have the requisite devices for the practice, leading to a lapse in their proficiency with these tools, as the absence of regular practice in their daily routines results in a diminished familiarity with their functionalities.

Figure-1: Some of the assistive technologies used by students in classroom and rehabilitation training.

Furthermore, students show reluctance towards the rehabilitation training, as observed in class 6, where two students refused to attend the rehabilitation session when a teacher asked them to go to the computer lab. One of the students told the researcher:

"This is a waste of time; they take periods of our other classes, and there is no benefit; the devices are expensive."

The other student said:

"These are such expensive devices, and we can only read the recorded books...phones are better; we can search for anything we want anytime on the internet."

The students' reaction indicates that they are disappointed by the rehabilitation training as they are aware that the devices are not affordable financially and that getting training for them is pointless. Silondwa and Muzata (2019) discuss that assistive technologies are usually developed outside the country, which makes them expensive and financially inaccessible for SVIs. On the other hand, class lectures and smartphones are easily accessible and affordable. Also, Senjam et al. (2021) found in their study that the two major barriers to accessing assistive technologies are unavailability and economic constraints among students who are acquainted with the assistive technologies.

Habituation to Braille

All the students in this school are taught reading and writing Braille script from class 1. They practice Braille daily through language, science, and social science classes. Teachers also encourage them to read the books and take notes from them. One of the class 6 students said:

"Sir helped us a lot in reading Braille...he says that we must have Braille letters in our memory so we do not have difficulty reading Braille script."

Students are accustomed to reading and writing Braille whether they have low vision or are totally blind; therefore, they feel more confident learning through Braille. As one of the students of class 8 said:

"Ma'am...How will a blind read if not from Braille?... and we understand well reading through Braille and reading practice is also needed"

The statement asserts that students perceive Braille as the most convenient and effective medium for understanding text. Braille engages a different cognitive pathway than visual reading, potentially leading to deeper comprehension and information retention. Also, it empowers SVIs to access information directly without relying on sighted assistance.

The other student in class 7 said:

"We read through Braille, and sometimes sir send the audio of question answers, and we note them on sheets of paper."

Students are so accustomed to Braille that even audios are utilized after converting them into Braille notes. Studies (Bhatt & Kumari, 2015; Senjam et al., 2022) show that SVIs are reluctant to adopt new assistive technologies because learning to use new devices requires practice and time.

One of the students of class 6 said:

"...Until eighth, we read through books and afterwards students use audios... now we only require books for reading and PDFs of NCERT have diagrams when we listen to them. The diagrams were read as some weird codes."

The other class 8 student said:

"Ma'am Braille is the most convenient way to read; suppose sometimes we do not have internet; how we will read through audio or InstaReader."

Another student of Class 8 said:

"...Yes, there are many reading devices, but we need to purchase them, and they are expensive and can get damaged over time."

In the above excerpts, the limitations of assistive technologies are highlighted, emphasizing that their effectiveness hinges on appropriate user input. While technologies like Daisy Players offer specific functionalities like data reading, recording, and storage, their narrow scope and potential expense raise concerns about their suitability for broader assistive applications. Studies (Bhatt & Kumari, 2015; Borg et al., 2015) also conclude that one of the challenges of adopting assistive technologies is its high cost and non-availability. Furthermore, Borg et al. (2015) explain that less awareness about assistive technologies and the lower purchasing capacity of people can hamper production and result in high costs. These concerns highlight the nuanced relationship between technology and individual needs, where advantages and drawbacks must be carefully considered.

Limitations of Braille

Braille has significantly supported the education of SVIs. It helped in independent learning by tactile and kinesthetic input. However, braille books have limitations as they do not have diagrams, figures, or graphics to illustrate a particular science or social science concept. As one of the students of class 7 said:

"No diagrams are there in the book... there is only a mention of diagram that the print version had the diagram on this particular page; it becomes difficult for those who are totally blind have not experienced that diagram visually."

The other student said:

"We are blind; we do not need diagrams... even when there is some mention of a diagram while reading, sir, always skip it."

The above responses highlight that the teachers and students believe that diagrams can be experienced visually. This belief limits the scope of utilization of alternatives such as tactile diagrams and 3D models for learning the concepts. However, it is argued that the tactile and kinesthetic value of tactile diagrams, maps, 3D models and charts, and graphs have educational implications for SVIs (Penny and Mary, 2001, as cited by Haider & Zaman, 2015).

Smartphones as Assistive Technology

After Braille, smartphones are the second-best preference as an assistive technology that students use for education and leisure. In contemporary times, smartphones come with accessibility features that help SVIs navigate through the phone and search for anything that piques their curiosity. However, before 2019, the students relied on Braille books only. As one of the class 8 students said:

"Earlier, we did not have phones; it's all because of COVID that our parents had to buy them for us."

Another student said:

"I got the phone during COVID because teachers were taking online classes on Google Meet."

COVID has allowed the SVIs to explore other technologies like TalkBack, Read Aloud, and voice assistance software. Similarly, Senjam et al. (2021) argue that recent technological advancements have equipped mobile technology with sound and haptic gestures to interact with smartphones. SVIs sometimes clear their conceptual doubts by visiting different sites and downloading various mobile applications. As one student said:

"I am interested in astronomy, so I search about space and planets on YouTube."

Moreover, for SVIs, smartphones have transcended the limitations of traditional textbooks, opening doors to diverse educational and leisure opportunities. Audio-based applications offering narrated stories, podcasts, and even NCERT textbook PDFs through document reading software like InstaReader and AdobeReader's read-aloud features have broadened their content engagement. This technology extends their learning beyond prescribed curricula, allowing them to delve deeper into topics that pique their curiosity through independent online research. Smartphones further enrich their lives by serving as portals for leisure activities like music listening, cricket commentary, and entertainment news, fostering connection and enjoyment beyond academic pursuits. In essence, smartphones have become indispensable companions for SVIs, enriching their educational journeys and leisure pursuits.

Conclusion

In summary, the school has limited availability of assistive technologies. Economic constraints are the reason for the unavailability of assistive technologies, as the school exhibits a limited capacity to adequately provide fundamental amenities, including traditional assistive technologies. Due to such financial constraints, it is difficult to afford expensive assistive technologies with functional specificities. Therefore, students and teachers both rely on traditional assistive technologies as these are affordable and accessible for them. Moreover, the rehabilitation program has given the SVIs exposure to modern assistive technologies and helped them learn about the functionalities. However, limited interaction with these modern assistive technologies does not engage the SVIs in the same way as the traditional assistive technologies do. Similarly, COVID has allowed SVIs to engage with smartphones and explore different accessibility features. Engagement with assistive technologies involves the intersubjective dimensions, such as social and learning dimensions of assistive technologies, as well as existential dimensions of impairment and disability (Berndtsson, 2018). Therefore, accessing assistive technologies not only requires the availability of it but continuous interaction and practice to make it a part of one's existence.

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Research Article

Navigating the Role of ChatGPT in Education from the Perspectives of PhD Scholars

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Abstract

As an Open AI language model, ChatGPT generates one billion visitors per month. The specialists in ChatGPT ensure that it will explore all fields, especially the educational system, because of its natural language processing and provision of human-like responses. This innovative technology has the power to transform traditional educational approaches and create a more dynamic learning environment for students around the world. Some teachers and educators perceive it as an educational tool for supporting teaching and learning processes in the classroom. They are also seeking tremendous opportunities to include ChatGPT in the educational system. Moreover, they are also concerned about the ethical issues and challenges of using ChatGPT as an educational tool. The present study reveals the opportunities and challenges of ChatGPT in education from the perspectives of PhD scholars. The major findings on perceptions of ChatGPT in education highlight its ease of use, student-centric approach, personalized learning capabilities, and broad applicability for content creation as a pedagogical tool. However, challenges such as concerns about authenticity, ethical issues, impacts on critical thinking and creativity, and the necessity for teacher competence and training are also significant. In this study, a qualitative, semi-structured interview approach was employed for data collection, conducted with 30 PhD scholars chosen via a convenient sampling technique, and the data were analyzed using thematic analysis.

Keywords: Artificial Intelligence, Chatbot, ChatGPT in Education, Opportunities, Challenges

Introduction

The world and the lives of human beings have been orbiting around a digital explosion for recent years. The remarkable advancement in Artificial Intelligence (AI) has permeated every aspect of human life, like healthcare, transportation systems, education, and entertainment. The term AI has been around for several decades, and it was coined in the 1950s by computer scientist John McCarthy, one of the founding fathers of AI (Hassani et al., 2020). AI generally means building a computer program similar to human intelligence, such as reasoning, perception, decision making and natural language processing (Kahn & Winters, 2021). The world of AI is as diverse as it is fascinating, encompassing an array of technologies such as chatbots, ChatGPT, autonomous vehicles, image recognition systems, and machine learning algorithms. Chatbots or conversational algorithms have been familiar for years and used in everyday life in the case of e-shopping, booking a flight ticket, movie ticket and food delivery (Zemčík, 2019). A chatbot is a computer program in the form of a virtual email correspondent that can reply to messages from computer users

(Definition of Chatbot | Dictionary.Com). The idea of ELIZA, the first Chatbot, was raised from the thoughts of Alan Turing about how a computer program can be used to talk with a group of people (Adamopoulou & Moussiades, 2020). Now, it explores advanced chatbots by breaking the major limitations of traditional chatbots, like understanding and generating natural language and the ability to handle complex or unexpected user input. As an OpenAI language model, ChatGPT generates one billion visitors per month. The specialists in ChatGPT ensure that it will explore all fields, especially the educational system, because of its natural language processing and provision of human-like responses. This innovative technology has the power to transform traditional educational approaches and create a more dynamic learning environment for students around the world. Some teachers and educators perceive it as an educational tool for supporting teaching and learning processes in the classroom. They are also seeking tremendous opportunities to include ChatGPT in the educational system. Moreover, they are also concerned about the ethical issues and challenges of using ChatGPT as an educational tool. This paper discusses the most advanced and sophisticated chatbot, ChatGPT, from PhD scholars' perspectives. The present study reveals the opportunities and challenges of ChatGPT in education from the perspectives of PhD scholars. Here, the method used for data collection is a qualitative, semi-structured interview method, which was carried out on 30 PhD scholars selected through a convenient sampling method.

Brief Literature Review

ChatGPT: Overview

ChatGPT is a powerful, transformative, artificially intelligent tool developed by OpenAI based on recent advancements in AI and Natural Language Processing (NLP) (Dwivedi et al., 2023). The GPT (Generative Pretrained Transformer) was first introduced by OpenAI in 2018 as a language model (Ollivier et al., 2023). The third version of the GPT series, GPT-3, was released in 2020 (Dehouche, 2021), followed by GPT-1 and GPT-2 language models. ChatGPT is a derivative of GPT-3 specially designed for use in conversational interfaces such as chatbots. ChatGPT is a sophisticated AI language model used for various tasks, including language translation, content creation, and (Javaid et al., 2023) chatbot development, in all contexts of society. Like ChatGPT, there are more recent Chatbots such as BlenderBot, and GPT-4, also known as LaMDA, is the latest version of OpenAI's GPT series (O'Leary, 2023) released on March 14, 2023, and was considered a significant advancement from GPT-3.5 for ChatGPT, impressing observers.

ChatGPT in Educational Context

Education is constantly evolving with the latest trends in technology. OpenAI ChatGPT stands at the forefront of modern education, revolutionizing every aspect of the education sector. According to the available data, ChatGPT crossed one billion users worldwide in March 2023 (Ruby, 2023). The availability, accessibility, conversational interface, multilingual support, easiness of getting knowledge, etc., made it famous in different fields of society, especially the education sector. ChatGPT is gaining popularity and becoming appealing in the higher education sector (Baig & Yadegaridehkordi, 2024). Now, teachers, researchers, and professionals are seeking various opportunities to include ChatGPT to update the modern educational system. The limitless opportunities of ChatGPT can be leveraged to build new teaching approaches, boost student participation and teamwork, enhance learning,

promote hands-on and experiential learning, stimulate collaboration among students, improve the evaluation capabilities of instructors and innovate new assessment strategies (Firat, 2023a). Also, large language models have the potential to provide a wide range of opportunities for professionals and students at all levels of education (Kasneci et al., 2023) (from the elementary to higher education sectors). This includes strategies for personalized learning and asynchronous learning, helps in teacher lesson plan preparation and professional development, for research and writing, etc. Students prefer chatbots such as ChatGPT due to their various advantages in the educational experience (Ngo, 2023; Stöhr et al., 2024). They are motivated to use this human-like interface (Shoufan, 2023). For these reasons, many specialists in this field believe that ChatGPT will become a vital component of the educational system as soon as possible (Mhlanga, 2023).

Besides the wide opportunities the ChatGPT provides, there are serious challenges too (Gordijn & Have, 2023). They are reliability and accuracy of scientific work, overreliance on AI, quality control, large energy consumption and environmental impact, privacy and safety concerns of users (Ray, 2023), slowdown of real-time responses, the chance of misinformation, ethical issues (Lo, 2023), the digital divide, copyright issues, etc. Also, when considering the higher education system, there is much scope for plagiarized works on behalf of students without using their creativity and critical thinking, like submitting assignments and projects (Dehouche, 2021). But some strategies can be used by the teachers to prevent plagiarism, like close monitoring of work (originality, checking for sources, and citation), educating students on the bad effects of plagiarism, using plagiarism-checking tools, and providing clear-cut guidance on how to use GPT-3 (Cotton et al., 2023). The further issues caused by ChatGPT are multilingualism and fair access to all, which are critical issues to consider; otherwise, it will create a significant digital divide and education gap worldwide (Kasneci et al., 2023). Research indicates that ChatGPT development remains nascent, focusing on natural language processing and comprehension, dialogue systems, speech processing and recognition, learning systems, chatbots, and response generation (Baber et al., 2023). However, OpenAI's research team is constantly working to improve the capabilities and reliability of ChatGPT and overcome the challenges (Sohail et al., 2023). If it's possible, AI will have a significant impact on the whole world of human beings in all aspects. Unfortunately, many educators and educational institutions are unaware of the effective integration of technology into their teaching (Redecker, 2017a). Studies are carried out on the perception of students and scholars on ChatGPT from Turkey, Sweden, Canada, and Australia. The study findings identified different aspects of ChatGPT (Firat, 2023b). However, students are still skeptical about using ChatGPT positively impacting academic purposes (Singh et al., 2023). As students' reliance on ChatGPT grows, educational institutions must thoughtfully explore its integration into the assessment procedure. It is essential to create evaluations that promote the responsible use of ChatGPT, safeguarding students' critical thinking skills and creativity in their writing assessments (Maheshwari, 2024). However, there are concerns about the authenticity and ethical aspects of the data generated by these. Faculty members in Pakistan typically have a negative perception of ChatGPT, voicing major worries regarding risks like cheating and plagiarism while recognizing advantages such as easier lesson planning and assessment. The

study shows that university teachers need additional information and training on ChatGPT to effectively decide on its application in education (Iqbal et al., 2023).

Research gap identified in the literature

While there is a growing body of research examining the perceptions of students, teachers, and educators regarding ChatGPT in various educational contexts, these studies remain limited and largely in their infancy. Notably, research specifically focusing on the perceptions of PhD scholars is scarce, and there is a significant lack of studies addressing these issues within the Indian context. The current study discusses PhD scholars' perspectives on the opportunities and challenges of ChatGPT in education through qualitative, semi-structured interview methods. Twelve open-ended questions were included and constructed by the researcher.

Research Purpose and Questions

The study is carried out to examine the PhD scholars' perception of the challenges and opportunities of ChatGPT in education. A semi-structured interview method was adopted to find out this. Which consists of the following questions.

1. Have you ever used ChatGPT as an educational tool? If so, what was your experience like?
2. What is your perception of the use of ChatGPT in the education system?
3. In what ways do you think ChatGPT can be utilized to enhance the teaching and learning process?
4. What challenges do you foresee in using ChatGPT in the education system?
5. How do you think the use of ChatGPT will impact the role of teachers in the classroom?
6. What precautions do you think should be taken to ensure the ethical use of ChatGPT in the education system?
7. What are your thoughts on the potential of ChatGPT to personalize learning and meet the individual needs of students?
8. How can teacher educators be trained to effectively incorporate ChatGPT into their teaching strategies?
9. In your opinion, what are some of the limitations of ChatGPT as an educational tool?
10. What do you see as the future of ChatGPT in the education system?
11. Do you have a positive/neutral/negative attitude about ChatGPT as an educational tool? Why?
12. Did you use ChatGPT for your research purposes? If yes, what are the ways ChatGPT will help you as a researcher?

Method

A qualitative approach and semi-structured interview technique were used to get the ChatGPT perception of PhD scholars.

Participants

For the study, convenient sampling methods were used. The sample consisted of 30 PhD scholars from the Kasaragod and Kannur districts.

Data Collection

Convenient sampling methods were used for the data collection process. The interview data was recorded as audio.

Data Analysis

After all interviews, thematic analysis was carried out for data analysis. For this purpose, the collected interview data was analyzed question by question, and then recurring themes were identified from the responses.

Result

30 PhD scholars of Kasaragod and Kannur University were selected for the interview. Only 17 PhD scholars (56.67%) tried ChatGPT, and 10 PhD Scholars (33.33%) are exploring its maximum potential as an educational tool. The users have good experience in one word. However, when further questions were asked, it revealed a wealth of information on the opportunities and challenges of ChatGPT. It is very exciting that the study found that 13 PhD scholars (43.33%) have never tried it, and they have very little awareness.

Discussion

Research Question 1: Have you ever used ChatGPT as an educational tool? If so, what was your experience like?

The 17 PhD Scholars are impressive, and they have good experience with the data getting beyond their thinking and don't think that much at all times. For them, more attractiveness is easiness in using and getting ideas very quickly. Many studies discuss the potential concern of how a chatbot like ChatGPT can help the researcher (Khlaif et al., 2023; Sallam, 2023; AlZaabi et al., 2023). However, some of them have had bad experiences with ChatGPT regarding the reliability and accuracy of the content.

Research Question 2: What is your perception of the use of ChatGPT in the education system?

Only a few PhD scholars are perceived at all levels of ChatGPT in the education system. The active users are interested in how ChatGPT responds to a particular question. They admit that the outstanding and attractive capabilities of ChatGPT to provide natural language have much to do with being an educational tool (Opara et al., 2023). Also, they pointed out its broad applicability to content creation, its benefits in getting new and vast ideas, and its immediate solution to a problematic question and language learning. On the other hand, they are very concerned about its limitations too. There are similar studies, like the perception of ChatGPT in education, which resembles all the above concerns (Chellappa & Luximon, 2024 such as ChatGPT, have contributed to their growing popularity in education. However, there is currently a lack of evidence regarding the perception of ChatGPT, specifically among design students. This study aimed to understand the product design (PD; Arguello et al., 2024).

Research Question 3: In what ways do you think ChatGPT can be utilized to enhance the teaching and learning process?

The PhD scholars believe that ChatGPT can potentially enhance the teaching-learning process in some way, and they suggested several forms for including ChatGPT. They are: ChatGPT can be used as a pedagogical tool, teachers can develop instructional devices based on that, and teachers can engage students actively by adopting different methods of teaching-learning process inside and outside the classroom with the help of ChatGPT. If a teacher is assisted correctly on how to use ChatGPT by the student for language learning, doing assignments, and solving problems using their brain, it will become a new trend in learning. Studies show how ChatGPT can be a supporting tool in the teaching-learning process (ElSayary,

2024resulting in the emergence of a "knowledge society." However, students and teachers have faced challenges in adapting to this digitalization. In the United Arab Emirates (UAE ; Baidoo-anu & Ansah, 2023; Ali et al., 2024).

Research Question 4: What challenges do you foresee in using ChatGPT in the education system?

Moreover, regarding the potential benefits of using ChatGPT, the PhD scholars are very concerned about the challenges and limitations of ChatGPT in the education system. If someone becomes too reliant on ChatGPT for their learning, it may hinder their creativity and limit their capacity for critical thinking. Especially if the students are not trained in using ChatGPT, it will lead to merely copying data for their assignments and homework (Adeshola & Adepoju, 2023). Other major challenges they foresee are a lack of ensuring authenticity and control of data provided by the ChatGPT. Because sometimes it provides limited ideas and less clarification for some topics, in some cases, bias and inaccuracies in the data also happen, and there is no provision to ensure the authenticity of data, so students should not rely on ChatGPT alone. Also, some of them suggest that blind dependence upon ChatGPT will cause a more negative impact on the teaching-learning process rather than good output (Farrokhnia et al., 2024). So, in the educational system, teachers have to train the students properly about how to use ChatGPT in a better way; otherwise, it will block the natural thinking capacity and creativity of students. There are studies which show that AI-based chatbots like ChatGPT's significant role in critical thinking (Essel et al., 2024; Suriano et al., 2025).

Research Question 5: How do you think the use of ChatGPT will impact the role of teachers in the classroom?

PhD scholars believe that the role of the teacher cannot be replaced by anything. However, there is concern that students may rely too heavily on ChatGPT for their educational needs if the teacher neglects them for their doubt clarification and less care in the classroom. Even if the teacher cares about students to some extent, due to its vast knowledge availability and ease of getting information, there is a possibility that they may prefer ChatGPT over their teachers. Not only these things but also ChatGPT's human-like response and free resource support for learning will sometimes affect the student's dependency on it rather than the teacher. For that, PhD scholars mentioned the importance of being a conscious and alert teacher even though AI is a machine and can't provide emotional support for students.

Research Question 6: What precautions do you think should be taken to ensure the ethical use of ChatGPT in the education system?

PhD scholars are unaware of the extent to which precautions can be taken for the ethical use of ChatGPT in the educational system. However, some of them suggested the importance of cross-checking the content delivered by ChatGPT by the teacher. Like when a student is submitting assignments and homework the teacher has to ensure that the student did the work and understands it.

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Research Question 7: What are your thoughts on the potential of ChatGPT to personalize learning and meet students' individual needs?

The PhD scholars are concerned about our current situation of a sizeable student-teacher ratio in a classroom. Because of this, teachers can't take care of everyone at a time, and then here they added the importance of ChatGPT for personalized learning. Because of the time limits, sometimes the students and their doubts were unknowingly neglected by the teacher inside the classroom. Here, the PhD scholars pointed out some attractive characteristics of ChatGPT that emphasize personalized learning to meet the students' needs. Through ChatGPT, the students get individualized doubt clarification at their own pace and time. Sometimes, in the classroom, some students are scared to ask doubts, and here, they can freely ask their doubts to ChatGPT without fear. Also, they can choose their learning style while using ChatGPT.

Research Question 8: How can teacher educators be trained to effectively incorporate ChatGPT into their teaching strategies?

They are concerned about teacher educators' unawareness of technology integration in education, especially new trends like ChatGPT. Most teacher educators still stand with the traditional chalk-and-board classroom. To avoid this problem, they all suggested the authorities make proper provisions for pre-service and in-service training programs for teacher educators, including workshops, refreshment courses, expert classes, and online orientation courses at all teacher education levels. If the teachers are getting proper training on these challenging trends in the educational system, there is nothing to fear about the upcoming generation.

Research Question 9: In your opinion, what are some of the limitations of ChatGPT as an educational tool?

The limitations of ChatGPT, which was coined by PhD scholars, are that it works fully on a network-bound platform, and now the basic version is free. This causes the digital divide in our educational system, one of the significant limitations restricting equal and quality educational opportunities worldwide. The other limitations pointed out are that ChatGPT couldn't provide the latest and recent data, the problems with authenticity and ethical issues with information getting; while using ChatGPT, it calls for enquiry nature from the user, while communication, even if it supports natural language processing and conversational mode of learning it lacks emotional intelligence. It will restrict students' cognition if they

rely entirely on it. Also, it cannot provide much information on the Indian context, such as specified things.

Research Question 10: What do you see as the future of ChatGPT in the education system?

The PhD scholars pointed out that if ChatGPT were improved and updated on its limitations, in future, it would transform our educational system in all dimensions. Some scholars argue that it has much scope in the future in the higher education sector rather than the elementary level. It will enhance the possibilities of personalized learning to all extent in the higher education sector in the formal and non-formal education sectors.

Research Question 11: Do you have a positive/neutral/negative attitude about ChatGPT as an educational tool? Why?

Most scholars have a positive attitude towards ChatGPT and enjoy its use and support in education. No one is against ChatGPT as an educational tool because of its impressive wide range of information and ease of use. However, some scholars are neutral because they are concerned about the limitations and challenges. If ChatGPT were advanced, it would indeed have the potential to win the hearts of students, teachers, and education experts.

Research Question 12: Did you use ChatGPT for your research purpose? If yes, in what ways will ChatGPT help you as a researcher?

ChatGPT is a relatively new trend in education and research, but most scholars are still in the experimental stage regarding its use. Out of 17 PhD scholars, only 10 were use ChatGPT for research purposes. They found ChatGPT can be used to find related topics and studies, collect literature reviews, find relevant references and get additional resources to develop their study.

Educational Implications

The following are the educational implications of the study based on the above findings.

- The study's findings highlight the importance of providing training programs for teacher educators on integrating AI-powered tools in the teaching-learning process.
- The study recommends the development of AI-supported teaching methodologies and instructional devices on behalf of researchers, teachers and experts in AI and education.
- The study also reveals the digital divide problem in the educational system. So, the authorities should take some actions that pave the way for all students equal access to AI advancements without any barriers.
- The study's findings, like AI-supported personalized learning, the wide applicability of AI in elementary education to higher education, and ethical aspects of AI in education, highlight the need for further research by experts in these areas.

Limitations

- The data is collected from only 30 PhD scholars of the Kannur and Kasaragod districts.
- Semi-structured interview methods were carried out for data collection.
- Convenient sampling methods were used for the study

Conclusion

Now, ChatGPT represents the revolutionary trend of AI applications

in all fields, especially education. The advanced features of ChatGPT, like NLP, instant access and availability of a wide area of information, are favoured by some PhD scholars, and they are aware of both the wide opportunities and challenges of ChatGPT as an educational tool. But the reality is exciting; here, most of the research scholars are still in the initial stage, and none are interested in experimenting with new technological innovations in simple featured artificial intelligence like ChatGPT. The concerns expressed by PhD scholars regarding the negative impact of ChatGPT on the academic field reflect a broader apprehension about the lack of awareness surrounding the controlled and constructive use of such chatbots in educational settings. This indicates a need for increased education and training to promote the responsible integration of AI tools in academia. The rapid adoption of ChatGPT, reaching over 100 million users within just two months of its launch, underscores a concerning situation in the Indian context where a significant portion of the global population engages with this technology without adequate understanding or guidance. This phenomenon raises critical questions about the implications of such widespread use, particularly in educational contexts, where the potential for positive and negative impacts remains largely unexplored. At national and international levels, there are several frameworks, self-assessment tools and training programs for teacher educators to assess and support their digital competency in the field of education (Redecker, 2017b) educators require an increasingly broad and more sophisticated set of competences than before. In particular the ubiquity of digital devices and the duty to help students become digitally competent requires educators to develop their own digital competence. On International and national level a number of frameworks, self-assessment tools and training programmes have been developed to describe the facets of digital competence for educators and to help them assess their competence, identify their training needs and offer targeted training. Analysing and clustering these instruments, this report presents a common European Framework for the Digital Competence of Educators (DigCompEdu. So, there is an urgent need for awareness and training programs for teacher educators at all levels. It should ensure that the teacher educators are equipped with the skills and knowledge to effectively integrate new trends in technology into the educational system.

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Research Article

Predicting Student Performance Using Past Data during COVID-19 Pandemic: A Validation Study

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Abstract

COVID-19 has been a time of test in almost all sectors of life, and education is not an untouched sector. The online teaching-learning process emerged to be the only viable and effective mode of carrying on instructional processes in HEIs. However, it became difficult to ensure that learning happened the way it is expected in the offline mode of teaching-learning. The guiding underlying rationale behind the present study is the impact of teaching online mode on students in terms of learning and evaluation. Student testing and evaluation without the assurance of meaningful learning is an emergent problem owing to poor online connectivity and the digital divide denying democratic access to all learners. Through the present study, the authors want to propose that some indigenous alternative strategies should always be tested and tried in advance to evaluate students. This can solve the problems of unforeseen, unfavourable and unpredictable times, such as the COVID-19 pandemic, with regard to student evaluation. The study aims to suggest a viable student evaluation strategy using the statistical technique of prediction. The present paper discusses this effective and innovative strategy tried out using the available examination result database of the PG programme students from Mizoram University for three consecutive sessions spanning from 2015-2019 and the prediction of the final semester result of the 2018-2020 session. Pearson product-moment correlation, regression analysis, and Student t-test were used to analyze the data. The result of the analysis suggests that statistical prediction must be adopted as an alternative strategy for evaluating students.

Keywords: Prediction using Past Data, Student Performance, COVID-19 Pandemic, Validation Study

Introduction

When the COVID-19 pandemic hit the world, no one had the faintest clue about the drastic impact it has in terms of shattering the educational systems worldwide. Education as a sector has been seriously impacted due to the closing down of educational institutions, which are prime public places. Due to the high transmission rate and rapid spreading of the COVID-19 virus, a complete lockdown of all kinds of public activities was done worldwide as a measure to curb the pandemic in the face of no effective measures and vaccines (Mudenda et al.,2023). This led to the shutting down of educational institutions right from school education to higher education institutes. Closing of schools, institutions and other learning spaces impacted more than 94 per cent of the world's student population (Pokhrel & Chhetri, 2021). The higher education institutions of learning in 185 countries were closed (Marinoni et al.

2020). The impact of this pandemic on public institutions is of manifolds more of a negative nature. Offline mode of education, especially in India, has been the most viable and effective means of conducting the teaching-learning processes both in schools and Higher Education Institutions (HEIs). But in the face of the COVID-19 pandemic worldwide, a sudden switching on to an online mode of education has not been so easy for both teachers and students. Especially in places where the digital form of education is a new thing, there are many questions surfacing in everyone's mind. Technology, on the one hand, is disruptive, failing to establish connections with the affective and psychomotor domain along with the cognitive domain of the learner, whereas on the other hand, it is rewarding by enabling the continuation of education amidst the pandemic (Kaur & Vadhera, 2021). The teaching community is facing challenging scenarios in the new mode of online teaching-learning processes as they have never faced it before. Our teaching-learning processes had always been in face-to-face mode. With the upsurge of the pandemic, the digital platform of education became the most promising medium we had, and only in the past few years that HEIs realized its potential and gravity when they actually used it. However, in a country like ours, where a large digital divide is already built in the societal milieu, it is very difficult to predict the role of technology in student evaluation practices and benefits. Every student does not have equality on the grounds of the quality of technological access. The problem is two-fold: firstly, access to the right digital platforms is restricted to urban-economically well-to-do sections of society and secondly, not all higher education teachers are prepared for this change in evaluating students. A similar scenario is visible in school education as well. Owing to the loss of education, parents of lower-grade students in schools felt that it would be better to let their children repeat the next academic year (Pokhrel & Chhetri, 2021). As the whole country witnessed the problem of evaluating students through online platforms of education, there was an urgent need to devise some innovative mechanism to evaluate students utilizing existing information databases so that in times of emergencies like the global pandemic, we can resort to some full-proof, tried and tested modalities of student evaluation. Innovation does not happen in a vacuum. Rather, it happens out of compelling circumstances that demand a reform of existing practices. Alternative assessments are a viable option for assessing students if measures are implemented to reduce associated academic integrity risks (Adama et al, 2023). A similar innovative thinking has been tried during the COVID-19 pandemic by predicting student's term end scores using regression analysis which may evolve as a suitable means of student evaluation in future. The practice is not new in the context of many developed educational systems worldwide, but it is very new in our country, especially its usage in student evaluation. In recent times predicting student academic performance has drawn considerable attention in education (Namoun & Alshanqiti, 2021). In the present study, the prediction of PG (postgraduate) students' end-term scores is made in terms of their SGPA (Semester Grade Point Average) scores in the fourth semester and CGPA (Cumulative Grade Point Average) of all 4 semesters. It is hypothesized that a prediction equation based on the previous year's database of students' scores of SGPA and CGPA can correctly predict the end semester SGPA and CGPA of any outgoing batch. This can thus enable safe prediction of students' examination results in the absence of a face-to-face mode of examination.

Rationale of the Study

University Grants Commission (UGC), the governing body for HEIs (Higher Education Institutions) in India, came up with guidelines for the conduct of examinations in the year 2020. The critical analysis of various alternatives of examinations suggested by the UGC gives a clue that there is always a scope for innovation in student evaluation at an institutional level reserved for adverse situations. As per the UGC guidelines, notified on 6th July 2020, there is a suggestion to the HEIs to follow any of the following three alternatives/models of examination to address the issues relating to the examinations of final year/semester students in the face of COVID-19 pandemic viz.: a) Traditional Examination; b) Online Examination &c) Blending of Traditional and Online examination. However, there is another alternative that has been suggested by various educationists and stakeholders like students, parents, and the community. Owing to the adversities of the digital divide, it is foreseen students are facing trouble in accessing digital platforms for education. Even if they gain access, the communication is asynchronous most of the time during the curriculum transaction due to poor network availability. Although technology-enabled classrooms are popularizing democratic access to education, the question of the successful transfer of value of knowledge often arises. The guiding underlying rationale behind the present study is the impact of teaching through online mode. Testing without assurance of meaningful learning has no meaning, and that was the crux of the problem of evaluating students in the midst of COVID-19 times. It is difficult to assess students' performance on collective fronts of cognitive, affective and conative domains. Students' mindset also needs to be explored in light of new evaluative modalities on account of the severe negative impact of the pandemic and stress. Therefore, it is felt that some alternative mechanism must be worked out in advance to enable a more transparent, viable, valid and reliable student evaluation process in the face of any crises. It is thus proposed that some indigenous alternative strategy should always be tested and tried in advance to solve the problems of unforeseen, unfavourable and unpredictable times such as the COVID-19 pandemic.

Objectives of the Study

A. Primary Objective:

To work out an alternative strategy to allocate end-term scores to PG program University students in response to the absence of a face-to-face mode of examination.

B. Secondary Objectives:

The secondary objectives have been classified into two sub-categories

Category 1: Objectives for Prediction of Scores

1. To find out the correlation between the average SGPA of the first three semesters with the SGPA of the fourth semester of students in 2015-17, 2016-18 and 2017-19 academic sessions separately.
2. To find out the correlation between the average SGPA of the first three semesters of all three batches of students (2015-17, 2016-18, & 2017-19) with their SGPA of the fourth semester.
3. To establish a simple regression equation for the prediction of the fourth semester SGPA from the average SGPA of the first three semesters.
4. To study the significance of the difference between predicted

SGPA and actual SGPA of the fourth semester.

5. To test the significance of differences between the average SGPA of the first three semesters and the SGPA of the fourth semester.
6. To study the consistency in students' performance in all four semesters.
7. To predict the fourth-semester SGPA of the target session (2018-20) on the basis of the regression equation.
8. To suggest a mechanism for the assignment of SGPA and CGPA to fourth-semester students of the ongoing batch of MA Education on the basis of the findings of this study.

Category 2: Objectives Post-Prediction of Scores

1. To correlate the predicted score of the fourth-semester SGPA and CGPA of the target batch, 2018-2020, with their actual obtained SGPA and CGPA scores, respectively.
2. To find out the correlation between the average SGPA of the first three semesters and the SGPA of the fourth semester of students of the 2018-20 batch for which prediction was made.
3. To study the significance of the difference between the predicted SGPA and actual SGPA of the fourth semester for the 2018-20 batch.
4. To test the significance of differences between the average SGPA of the first three semesters and the SGPA of the fourth semester for the 2018-20 batch

Methodology of Study

A descriptive methodology is used for the present study. The sample used for establishing the regression equation were the students' SGPA and CGPA scores from 2015 to 2019 for three consecutive batches of the M.A. (Education) programme of Mizoram University with proper consent from the Examination Department of Mizoram University. The target batch for which the prediction was made is the outgoing batch of the M.A. (Education) 2018-20 session. In the face of the sudden pandemic in 2020, the end-semester examination could not be conducted in traditional face-to-face mode. Instead, an online mode of examination was tried in the University for the first time, which created a lot of problems both on the part of teachers and students in providing and undergoing evaluation safely. Hence, small action research was performed to come out with an alternative strategy to allocate marks to students if the pandemic sustains and resurges in the near future. The following formula is used to calculate the SGPA and CGPA as reflected in the PG mark sheet of Mizoram University

SGPA= Sum of Grade Points awarded for a Semester/ Total Credit of a Semester.

CGP=Sum of Grade Points awarded for the entire Programme/ Total Credit for the entire Programme.

The CGPA between 8-10 is regarded as Distinction, of 6 and less than 8 is regarded as First division and CGPA between 5 and less than 6 is regarded as Second division. The study was conducted in two phases: firstly, the phase of predicting students' end semester scores and secondly, the analysis of data post-prediction of end semester scores.

Both descriptive and inferential statistics have been utilized for the analysis of data. Descriptive statistics,

like measures of central tendency and dispersion, are highly useful in explaining the data and finding patterns. Further, under inferential statistics, relationship analysis was performed using the Pearson product-moment correlation, which is justified since the students' academic achievement score relates to the interval scale of measurement. Student t-test of two-sample assuming equal variances was performed for testing of significance of difference pertaining to essential objectives of study. An f-test was performed to measure the variance assumptions of the sample.

Statistical Analysis and Findings:

I) Findings of Secondary Objectives for Prediction of Scores under Category 1

1. To find out the correlation between the average SGPA of the first three semesters with the SGPA of the fourth semester of students in 2015-17, 2016-18 and 2017-19 academic sessions separately.
2. To find out the correlation between the average SGPA of the first three semesters of all three batches of students (2015-17, 2016-18, & 2017-19) with their SGPA of the fourth semester.

Findings: It is found that there is a significant and very high correlation between the aggregate SGPA of the first three semesters and the SGPA of the fourth semester for each of the batches 2015-17, 2016-18 and 2017-19; the data of which was available to the investigators. Also, the overall correlation between the aggregate/ combined SGPA scores of the first three semesters and the SGPA of the fourth semesters combined for all 3 batches is also significantly high (Table 1).

Table -1: Correlation Coefficient Values between Aggregate SGPA of First Three Semesters and SGPA of 4thSemester

Independent Variable(X)	Dependent Variable(Y)	N	Df	Pearson's Correlation Coefficient	Significance level
Aggregate SGPA of First three Semesters of Batch (2015-17)	Fourth Semester SGPA(2015-17)	29	27	0.844	Significant**
Aggregate SGPA of First three Semesters of Batch (2016-18)	Fourth Semester SGPA(2016-18)	34	32	0.783	Significant**
Aggregate SGPA of First three Semesters of Batch (2017-19)	Fourth Semester SGPA(2017-19)	38	36	0.734	Significant**
Aggregate SGPA of First three Semesters of all three Batches (2015-17, 2016-18, & 2017-19)	Fourth Semester SGPA(2015-19)	101	99	0.808	Significant**

*Source: Field data. ** Significant at .01 level*

1. To establish a simple regression equation for prediction of fourth semester SGPA from the average SGPA of the first three semesters.

   On the basis of obtained value of overall correlation coefficient

between the aggregate SGPA of first three semesters and the SGPA of fourth semesters combined for all 3 batches a regression equation was tried to develop.

Following is the generalized form of the linear regression equation:

Y = Y intercept+ slope * X

Wherein X=IV (Independent variable);

Y=DV (Dependent variable)

X= Regressor Variable, Aggregate of First three Semesters of all three Batches (2015-2019)

Here Y intercept means the value of Y variable i.e. SGPA of Fourth Semester if X=0 i.e. IV=0

Table 2 depicts the obtained regression equation.

Table-2: Prediction of Regressed Variable (Y) from Regressor Variable (X)

Regressor Variable(X)	df N(101)	R^2	R	Standard Error of Estimate	Regression Equation for predicting Variable Y, SGPA of Fourth Semester
Aggregate of First three Semesters of all three Batches (2015-19)	99	0.653	0.808**	0.299	Y = 1.323+0.851*X

***Significant at 0.01 level*

1. To study the significance of the difference between the predicted SGPA and actual SGPA of the fourth semester for the three batches.

   On the basis of established regression equation, it was tried to see how it works with the available data of 3 consecutive batches (2015-2019). If it has a good power of prediction there should be no difference between the predicted scores and actual obtained scores in the fourth semester SGPA. A null hypothesis is thus proposed.

   Null Hypothesis: There is no significant difference in Mean Scores of Predicted and Actual SGPA scores of fourth semester

   Findings: It is found that there is a good power in the established regression equation in predicting students' 4th semester scores as there is no significant difference in predicted and actual scores (Table 3).

Table-3: Significance of Difference between Predicted and Actual SGPA of Fourth Semester Students of 2018-20 Batch

Variables	N	Mean	S.D.	SEM	't-value'	Df	'P value'	Signifi-cance of Differ-ence	Decision on H0
Predicted SGPA of Fourth Semester	101	7.459	.408	.0406	.039	200	.9689	NS	Accepted
Actual SGPA of Fourth Semester	101	7.446	.505	.0503					

NS: The test suggests that the difference between the two means is not significant at 0.05 level.

1. To test the significance of differences between the average SGPA of the first three semesters and the SGPA of the fourth semester.

   Also, it was tried to see whether the average SGPA score of students for the first 3 semesters differed from the SGPA scores of the fourth semester from the available data of 3 consecutive batches (2015-19). A null hypothesis was proposed as Null Hypothesis: There is no significant difference in Mean Scores of the average SGPA of the first three semesters and the SGPA of the fourth semester.

   Findings: The test suggests that in the available data the SGPA of fourth semesters had been significantly higher than the average SGPA of first 3 semesters. It indicates that scores in fourth semester are generally higher and perhaps judge the overall CGPA of the students (Table 4).

Table-4: Significance of Difference between Average SGPA of First Three Semesters and SGPA of Fourth Semester

Variables	N	Mean	S.D.	SEM	't-value'	Df	'P value'	Significance of Difference	Decision on H0
Average SGPA of First three Semesters	101	7.199	.4802	.0478	3.572	200	.0004	S**	Rejected
SGPA of Fourth Semester	101	7.446	.505	.0503					

***The test suggests that the difference between the two means is extremely significant at 0.01 level.*

1. To study the consistency in students' performance in all four semesters.

   Findings: The consistency of students' performance was also analysed using the available data from three consecutive batches. A bird's eye view approach was employed as the sample size was 101 only. It was found that the SGPA scores obtained in all 4 semesters were quite consistent, with a trend of gradual improvement towards the end of semesters. None of the students scored both SGPA and CGPA below 6 points. All were first class, and many obtained distinction points as well. This analysis was done to narrow down to the conclusion that in the past, the students' scores were indicative of consistency and can be taken as a clue that the trend of the traditional face-to-face mode of evaluation has been providing consistent scores with gradual improvement in higher semesters.

2. To predict the fourth-semester SGPA scores of the students of the target session (2018-2020) on the basis of the regression equation.

   For this analysis the obtained regression equation (1.323+ 0.851*X where X= aggregate scores of students obtained in first three semesters of 2018-20 session) was used.

   Findings: The description of predicted scores shows that the mean obtained SGPA score in the 4th semester is likely to be 7.634 (Table 5), indicating a predictable good performance of the outgoing target batch (2018-20).

Table-5: Descriptive Statistics of Predicted Scores of Fourth Semester SGPA of 2018-20 Batch of MA Education Students

Number	Mean of SGPA	Standard Error of Mean	Standard Deviation	Sample Variance
37	7.634	0.0491	0.299	0.089

1. To suggest a mechanism for the assignment of SGPA and CGPA to fourth-semester students of the ongoing batch of MA Education on the basis of the findings of this study.

   On the basis of estimated predicted scores, it was suggested that the strategy of providing grace marks in correspondence to the predicted SGPA of the students for end-semester examinations through internal assessments be applied only in the face of no examinations. However, with complete safety measures, the online mode of examination was conducted in August- September 2020, after the completion of the online mode of teaching-learning processes from April 2020 to August 2020 in all UG and PG departments under Mizoram University.

II) Findings of Secondary Objectives for Post-Prediction of Scores under Category 1

1. To correlate the predicted score of fourth-semester SGPA and CGPA of the target batch 2018-20 with their actual obtained SGPA and CGPA scores, respectively.

   Findings: Once the final results of the target outgoing batch of 2018-2020 were published in October 2020, it was tried to correlate the predicted and actual scores of the fourth semester both in terms of SGPA and CGPA. It was found that both the predicted and obtained scores are significantly and very highly correlated in the case of SGPA and CGPA. It is thus concluded that students' scores were correctly predicted for the target sample of students (Table 6).

Table-6: Correlation between the Predicted Score of Fourth Semester SGPA and CGPA of the Target batch 2018-20 with their Actual Obtained Scores

Variable 1	Variable 2	N	Df	Pearson's Correlation Coefficient	Significance Level
Obtained SGPA in Fourth Semester	Predicted SGPA in Fourth Semester	37	35	0.98	Significant**
Obtained CGPA in Fourth Semester	Predicted CGPA in Fourth Semester	37	35	0.99	Significant**

*Source: Field data. ** Significant at .01 level*

1. To find out the correlation between the average SGPA of the first three semesters and the SGPA of the fourth semester of students of the 2018-20 batch for which prediction was made.

   Findings: It was also tried to correlate the aggregate SGPA of

the first 3 semesters and the SGPA of the fourth semester for the target outgoing batch (2018-20). It was found that the correlation is significantly high, indicating that the trend is consistent with the earlier trend (Table 7).

Table-7: Correlation between the Average SGPA of the First Three Semesters and the Predicted SGPA of the Fourth Semester of Students of the 2018-19 batch.

Variable 1	Variable 2	N	Df	Pearson's Correlation Coefficient	Significance level
Aggregate SGPA of First three Semesters of Batch (2018-2020)	Fourth Semester SGPA(2018-20)	37	35	0.98	Significant**

*Source: Field data. ** Significant at .01 level*

1. To study the significance of the difference between the predicted SGPA and actual SGPA of the fourth semester for the 2018-20 batch.

   In order to study the significance of the difference between the Mean Scores of Predicted and Actual SGPA scores of the fourth semester for the 2018-20 batch following null hypothesis is proposed

   Null Hypothesis: There is no significant difference in Mean Scores of Predicted and Actual SGPA scores of the fourth semester for the 2018-20 batch.

   Findings: An insignificant difference between the predicted and actual mean SGPA of the fourth semester of 2018-20 is a clear indication/ evidence that predicted scores in this study were quite accurate (Table 8).

Table-8: Significance of difference Between Predicted SGPA and Actual SGPA of Fourth Semester of 2018-19 Batch

Variables	N	Mean	S.D.	SEM	't- value'	Df	'P value'	Signifi-cance of Differ-ence	Decision on H0
Predicted SGPA of Fourth Semester	37	7.63	0.299	0.049	1.76	72	0.081	NS	Accepted
Actual SGPA of Fourth Semester	37	7.51	0.293	0.048					

NS: The test suggests that the difference between the two means is not significant at 0.05 level.

2. To test the significance of the difference between the average SGPA of the first three semesters and the SGPA of the fourth semester for the 2018-20 batch.

   A null hypothesis is thus proposed, which is as follows:

Null Hypothesis: There is no significant difference between Mean Scores of the average

SGPA of the first three semesters and SGPA of the fourth semester for the 2018-20 batch.

Findings: A similar analysis of comparison of aggregate SGPA of the first 3 semesters and SGPA of the fourth semester of the target outgoing batch (2018-2020) showed that there is no significant difference, indicating that scores were given very consistent to students' last performance (Table 9). However, this trend was not in agreement with the earlier collective trend of the last three batches, where the fourth semester mean SGPA scores were significantly better than the last three semesters. This finding suggests that students in the target batch were given average scores to nullify the shortcomings of online teaching-learning processes. The student evaluative strategy followed the midway approach of neither being lenient in allotting marks nor being stringent at the same time.

Table-9: Significance of Difference between the Average SGPA of the First Three Semesters and SGPA of the Fourth semester.

Variables	N	Mean	S.D.	SEM	't- value'	Df	'P value'	Signifi-cance of Differ-ence	Decision on H0
Aggregate SGPA of First three Semesters	37	7.42	0.35	0.058	1.28	72	0.20	NS	Accepted
SGPA of Fourth Semester	37	7.51	0.29	0.048					

NS: The test suggests that the difference between the two means is not significant at 0.05 level.

III) Findings of the Primary Objective

The primary objective for the present study is to work out an alternative strategy to allocate end-term scores to PG program University students in response to absence of face-to-face mode of examination.

In 2020, an online mode of examinations was conducted for end-semester examinations in the face of the sudden pandemic in Mizoram Central University. In the Department of Education, statistical prediction of the scores of students was made through regression equations based on available data from the last three batches (2015-2019). A regression equation for predicting variable SGPA of the fourth semester was established, and scores were predicted. It was found that the predicted scores for the fourth semester SGPA and CGPA of the batch 2018-2020 are highly and positively correlated with the scores they obtained. The findings suggest that on the basis of prediction, marks could be allotted on the basis of internal assessments in certain emergencies, such as the current pandemic of COVID-19. On the basis of statistical findings, it is proposed that prediction can be used as a viable alternative model for students' evaluation. The power of prediction has been much less explored in evaluating students in our indigenous settings. The regression analysis suggests that students' predicted scores highly correlate with their actual

obtained scores; hence, it is a reliable and valid means to evaluate students who lack actual exams. It is suggested the end-term scores can be worked out on the basis of the available database of students. Maintaining a thorough database is thus a prerequisite for the implementation of this strategy.

Discussion

India, like many other countries, announced the cancellation of the school annual examinations and promotion of the students in the absence of examinations due to the increasing number of COVID-19 cases. This measure was taken to ensure students' safety. Several alternative strategies were worked out to decide the criterion of promotion on the basis of previous performances. When in the year 2021, both class X and class XII board exams were finally cancelled, a unique methodology was applied to calculate the final grades of students' board exams. For the CBSE (Central Board of Secondary Education) class X result declaration, as per the new evaluation criteria, schools evaluated students for 80 marks on the basis of the various internal assessments taken during the academic session, which was just 20 earlier. Similarly, for evaluating CBSE class XII results, the theory marks of each subject were computed using 40 per cent of the marks they got in the subject pre-boards or mid-term exams held by their schools earlier, 30 per cent from their Class XI final exam marks, and 30 per cent from their Class X board exam results. This was then added to the actual marks of students who got in their Class XII internal assessments and practicals for that subject. In a similar wakeup call, former Union minister Mr Kapil Sibal raised the question of online examination being "extremely discriminatory" (The Hindu, 2020). He mentioned that examinations shouldn't be the priority at the university level until there is a pandemic because there exists a digital divide in the country, especially in remote and rural belts, and hence examinations will be working against the students from poor and marginalised sections of society. However, he asserted that major changes would take place in the education system in the coming years with better internet connectivity and convergence across the country, which would enable better access to quality education in difficult pandemic situations. Digitisation is perhaps the only solution that will provide connectivity to every school and college in different corners of the country in the coming times. The unpredictability of the pandemic time needs strategic planning and better innovative solutions for proper student evaluation, as the present mechanism does not give a scope for democratic assessments. The present evaluative pattern favours the students with resources and works against those who do not possess them. The pandemic compelled us to think of this important aspect of education. Further, the University Grants Commission (UGC) released an advisory in July 2020 to follow any of the three alternative models for the evaluation of students, which were either to conduct a traditional examination following standard operating procedure or to conduct an online examination and a third model of blending of both the traditional and online examination was also suggested. However, many autonomous institutions like the IITs (Indian Institute of Technologies) and colleges have cancelled exams and have promoted students on the basis of past performance. IIT Goa came out with a unique method for evaluating students (Timesnownews.com, 2021). Students were asked to frame questions, answer them and get marks. The method adopted by IIT Goa is considered to be innovative and unique. Prediction of students' future performance is also one

such reliable and authentic mechanism which does not discriminate the unprivileged over privileged students. Also, regression analysis has been successfully used to predict the future performances of students in many advanced countries where the culture of maintaining databases is a common practice.

Considering the Indian context, the majority of the student population in higher education go for UG (Undergraduate) and PG (Postgraduate) programmes of 3 years and 2 years, respectively. Amidst the pandemic of Covid 19, HEIs across the country took a decision to cancel face-to-face examinations, including the end-semester examinations. Students were to face either the 2nd, 4th or 6th semesters for UG courses and the 2nd or 4th semesters for PG courses during the first wave of the pandemic. The first wave of the COVID-19 pandemic commenced with increased detection of cases in January-March 2020, with the September 2020 peak (Banerjee, 2020) with receding cases for the first time across the country by October 2020 (Hindustantimes.com). The present study evidently supports that the decision to promote students during the first wave of the COVID-19 pandemic in India was not futile. Specifically considering the end-semester examination, Table 10 depicts the summary of student evaluations already done and remaining in various UG & PG programs during the first wave of the COVID-19 pandemic. The summary conveys that when bulk student evaluation is already over, promotion on the basis of past performances is risk-free. As far as non-end semesters are concerned, student promotion is granted considering the amount of remaining time available for their complete assessments. It is very evident that high-performing students will consistently perform well in upcoming exams and vice versa. Today's educational system, especially Indian higher education, is very immune to change of any kind and is busy producing graduates and postgraduates, very much confirming the marks-ridden criterion of qualifying and succeeding in the examinations. For that matter, evaluation through examination is restricted to the filtration of candidates, and examinations provide no feedback on holistic aspects of one's progress. Feedback is the key to evaluation of any kind, and continuous internal assessment is the game changer. The prediction of students' scores is very much based on their continuously assessed performances on the basis of which future performance can be assessed. The method is highly reliable and authentic, leaving no scope for biased student assessment, which may operate and discriminate the unprivileged over privileged students. Regression analysis as a technique has been tested across time and space which has the potential to predict the future performances of students.

The present study reiterates this fact through the analysis done in the post-prediction phase,

where a very high correlation is obtained between the predicted and the actual end-semester scores obtained through online examination by the students of the Education PG program in the year 2020. Through the present study, the authors want to propose that some indigenous alternative strategies should always be tested and tried in advance to evaluate students. This can solve the problems of unforeseen, unfavourable and unpredictable times, such as the current pandemic, in terms of student evaluation.

Table-10: Summary of Evaluation Already Done and Remaining in Various UG & PG Programs during First Wave of COVID-19 Pandemic, 2020

Sl. No.	PG Programmes (2 yrs. Duration)	Students have Already been Examined For	Exams to be Conducted Only For
	M.A.	**3 Semesters** (75% of Teaching & Evaluation Through Traditional Mode is already over)	**4th Semester** (Only 25% Evaluation is Remaining)
	M. Sc.		
	M. Com.		
	M.B.A.		
	M. Lib. Sci.		
	M. Tech.		
	Any other PG Programme		
	UG Programmes (3 yrs. Duration)	Students have Already been Examined For	Exams to be Conducted Only For
	B.A.	**5 Semesters** (83% of Teaching & Evaluation Through Traditional Mode is already over)	**6th Semester** (Only 17% Evaluation is Remaining)
	B.Sc.		
	B. Com		
	L.L.B. (Three Yrs)		
	B.B.A.		
	UG Programmes (4 yrs. Duration)	Students have Already been Examined For	Exams to be Conducted Only For
	B. Tech.	**7 Semesters** (87% of Teaching & Evaluation Through Traditional Mode is already over)	**8th Semester** (Only 13% Evaluation is Remaining)
	M.B.B.S.		
	B.Ed.4yrs. Integrated		
	Any Other UG Programme of 3yrs duration		
	Integrated Programmes (UG+PG) (5 yrs. duration)	Students have Already been Examined For	Exams to be Conducted Only For
	Integrated MBA	**9 Semesters** (90% of Teaching & Evaluation Through Traditional Mode is already over)	**10th Semester** (Only 10% Evaluation is Remaining)
	Integrated LLB		
	Integrated M. Lib. Sci.		
	Any other Integrated (UG+PG) Programme		

Understanding the Online Teaching –Learning amidst the Covid 19 Pandemic: The Indian Context

Several new modalities found their way in, especially in the dynamics of online classrooms amidst this pandemic. Alternative assessments such as oral assessment or viva or live psychomotor skill demonstration via Zoom or similar video conferencing, submission of video recordings of presentations, take-home open book assessments, time-limited online open-book assessments and assignments, take-home long and short answer assessments are viable options for assessing students if measures are implemented to reduce associated academic integrity risks (Adama et al, 2023). The COVID-19 pandemic kindled a shift in traditional pedagogy, especially for university-level students, changing the way students learn, attend classes, or communicate with teachers (Tulaskar & Turunen, 2022). Innovative ideas like team teaching came up as a major choice by many higher education institutions across the country, offering tremendous benefits when it is tried in online mode. When two or more teachers interact collectively with students in online platforms they can prove to supplement and complement their assets and shortcomings. Their difference in teaching style actually enhances the attention and retention on the part of the students. In 2020 and 2021, for the first time, an online interface is adopted in Teacher Training Institutions (TTIs) spanning pre-internship, internship and post-internship online sessions (Dvivedi & Kaur et al.,2022). It was a successful attempt and is in the process of documentation in terms of teachers' and trainees' first-hand experiences. Students from the neighbourhood, available in the vicinity, were taught by pupil teachers solving the problem of the non-availability of schools for internship. The pupil-teacher recorded the lessons, creating a simulated environment for the purpose. They also created a laboratory at home for demonstrating simple experiences. Something out of the box was trying to overcome the boredom of online platforms of learning. Sometimes, students provide the best solution to a problem by peer-teaching, creating discussion forums, and using online space for writing, expressing poetry, and academic discussions during the online internship. Some special case studies of innovations in teaching sciences during the COVID-19 pandemic, such as biological laboratory in-house/out-of-school, technological embedment in preparing science projects and use of science learning demonstrative videos, etc., were tried in different online instruction times by the pupil teachers. The concept of CUBE (Collaboratively Understanding Biology Education) program at the Homi Bhabha Center for Science Education (Tata Institute of Fundamental Research) is a project-based science education program classes meant for teaching online and distance biology. It is one of the most successful ideas, and it is well-recognized and documented (Kharatmal, Nagarjuna & Yadav, 2020).

The year 2020 has been a big year for educational technology amidst the pandemic. A lot of ICT tools found their way to online classrooms, such as Google platform/workspace, including Google quizzes/ forms, jam boards (interactive boards), Google Docs, Google Sheets, Slido polls, Pedlet, Learning Management Systems (LMS) like Moodle, all used in Mizoram University along with other Indian HEIs. Software like Microsoft Teams, Zoom, Cisco Webex and social media tools like Whats app, Facebook, YouTube, etc., are being extensively utilized to facilitate the teaching-learning process. Traditionally, people think there are both pros and cons to applying technology to education. On one side, it offers great benefits of

reaching out to distant learners, but on the other side, it is problematic, especially in determining whether learning has occurred or not. The latter problem has doubled on account of the prevailing digital divide in the country. Technology is thus a means but not the end. The opportunities and challenges of emergency remote teaching-based experiences of COVID-19 times are vital knowledge reservoirs for taking up teaching-learning processes in the post-COVID times and now need to be documented for future planning. Many pertinent questions are on the floor, such as how can we make maximum use of the potential of our students through technology? Are the teachers ready to perform online evaluations with transparency? is the blended mode of teaching-learning processes the best for current times and the future? etc. The rise in student mental health difficulties has been a growing international concern long before the onset of the COVID-19 pandemic (Cuijpers et al. 2019). Working on student's emotional health is essential and hence the role of affect in online classes needs to be researched. Is it totally missing, or is it all the same? The online examination amidst the COVID-19 pandemic raised many questions about the authenticity of examinations, and their impact on the emotional well-being of students during the pandemic still remains an unaddressed question. As found by Reeves (2005), there is "no significant difference" in terms of students' achievement with respect to the modality of learning experiences, i.e. between offline and online teaching-learning processes. For many of us, teaching through online mode is as good as face-to-face, but we forget students' perspectives, experiences, and limitations. We need to focus on effect rather than cognition alone while teaching concepts.

According to Mok et al. (2021), many studies during the pandemic raised the issue of assessment while shifting to the complete online modality of transaction of content, leading to a serious impact on student competence. Further, it is reiterated in their study that this sudden shift to online learning has opened the room for improving the current assessment standards, leading to innovating new non-traditional methods not focusing on learning outcomes but on student experience. Innovative, creative and sustainable development skills of youth, which are missing in the present evaluative system in our nation, are to be prioritized. Evaluation on the basis of skilled competency is important. Providing emergency training for unfavourable circumstances such as a pandemic, providing counselling services for proper mental health, and involving learners' experiences and creative solutions are new lessons learned. Our training is very poor on digital platforms, and we have proven to be good teachers in face-to-face learning. How can we overcome the gap through minimal digital investment? Is a new question to be answered. Lessons need to be learned from developed countries which have used this pandemic time to devise and strategize new modes of examination and are still improvising to fit new situations. Some promising practices evolved during the last four years amidst the pandemic and post-pandemic times, which all need to be documented. Various ways to design meaningful learning experiences for students by adding technology to the methodology are being tried. However, adding technology should target improving the quality of students' experiences. Flexibility in design in terms of time, space, content (context-based), and evaluation is the call of the new days based on the central question: how do students feel they should be evaluated? An argument is

placed that responsibility for the design should be shared by both teachers and students, and students' needs should be bulk shared in designing experiences through technology (Oliver, 2015). Thus, where on one end, developed countries utilized the COVID-19 pandemic to innovate and refine existing practices of evaluating students online; on the other end, developing countries like ours had a chance to gain first-time experiences in online teaching-learning processes. The experience is unique both at the level of students and teachers and is a vital reservoir readily available for proper future education planning at HEIs specifically.

Conclusion

The objective of the present study was to draw attention to sensitive aspects of student evaluation through digital platforms, especially in the context of higher education. During the COVID-19 pandemic when, for almost the entire 2020-2021 session, online teaching-learning processes were the only valid and viable mode of instruction. It is very important to understand the validity of various digital platforms in educating the youth, especially in a nation like ours, where both teachers and students have the opportunity to have exclusive firsthand experience. The present study suggests that a culture of maintaining databases should be encouraged at higher educational levels so that effective and innovative strategies of prediction can be tried out. The present study made a similar attempt using the available examination result database of the PG programme students from Mizoram University. The result of the analysis is suggestive that statistical prediction must be adopted as an alternative strategy to evaluate students. Technology and its application in educational settings have proved to be a blessing in disguise in COVID-19 times. Across the globe, there are many best practices for evaluating students online, especially lessons from developed countries, which should be discussed more now in order to strengthen evaluative strategies. Some of the tested innovative strategies are an equal partnership of both teacher and students in designing digital experiences, discussion forums as an apt way to overcome the boredom of online platforms of learning, the concept of providing achievement badges to acknowledge learners and provide feedback, open book examination to bring in tr4ansparency in evaluative practices, use of problem-oriented integrated curriculum packages such as life skill, competency-based curriculum packages to strengthen learner's engagement, online team teaching, online /blended mode of internships in Teacher Training Institutions (TTIs) and statistical prediction of students' score. The importance of using students' data to drive improvement in education planning is one of the most used strategies, as well as techniques for obtaining knowledge from databases such as large arrays of student data from academic institution databases (Arsad & Buniyamin, 2014). The COVID-19 pandemic brought in tough times globally. The educational sector is deeply impacted, although the extreme situations enabled education to think out of the box. The pandemic, as a challenge, compelled us all to be more promising in our efforts to combat it. We learnt new things and practised them. Technology has become our partner in solving problems and providing innovative solutions in many places, but it has also become a hurdle for the marginalized section. The COVID-19 pandemic led us all to think of a different perspective on technology, mostly solving the problem of teaching only to those who have adequate resources to access it. Circumstantially, many new ideas for student evaluation were tried in many places where the prediction of

students' scores emerged as a valid and reliable alternative model which needs to be documented as an objective practice for the sake of transparency in student evaluation.

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Data Availability Statement (DAS)

Data shall be made available on demand.

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Research Article

Evaluating Perception of Delhi Government School Teachers towards the DIKSHA Platform: A TAM-Based Analysis

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Abstract

The Digital Infrastructure for Knowledge Sharing (DIKSHA) platform was launched by the Government of India to enhance the nationwide accessibility to educational content through digital means. By employing a descriptive research design, this study explores the perceptions of Delhi government school teachers regarding the DIKSHA platform using the Technology Acceptance Model (TAM). A total of 71 teachers were randomly selected from three regions in Delhi, and data were collected through a validated Likert-scale questionnaire. Findings revealed that teachers' engagement with the DIKSHA platform is hindered by various challenges, such as familiarity with the platform, infrequent usage, and accessibility of the training content. Correlation analysis showed that Perceived Usefulness, Perceived Ease of Use, Attitude and Behavioural Intention significantly predict the actual usage of the DIKSHA Platform among the teachers. Further analysis revealed that teachers with greater familiarity with the platform exhibited a moderate positive inclination towards its usefulness in classrooms. While those with more frequent usage demonstrated a stronger perception of its usefulness in classrooms. The study has its limitations regarding sample size, limited variables and geographical location. This study offers implications for various stakeholders in improving the adoption and utilization of the DIKSHA platform among school teachers.

Keywords: Attitude, DIKSHA, Perceived Usefulness, Perceived Ease of Use, TAM Model, Teachers

Introduction

Digitization of learning has greatly enhanced the accessibility of educational materials via the Internet, multimedia platforms and other online courses (Haleem et al., 2022). This online accessibility of educational content finds its roots in the Open Education Movement. It promotes the free sharing and adoption of digital educational resources with minimal constraints under open licensing frameworks (CIP, 2021). Recently, the world has faced unprecedented global events in the form of the pandemic, which enabled countries to revisit and accelerate the accessibility of learning materials through digital mediums (UNDP, 2023).

In this step, the Government of India in 2020 had launched the PM eVIDYA platform to achieve the vision of One Nation, One Digital Learning Platform. This initiative aims to meet the diverse educational requirements of the students through one single digital platform (MoE, GOI, 2020). PM eVIDYA programme accumulates various initiatives taken by the Government of India such as DIKSHA, Swayam, SwayamPrabha DTH Channels, Special

e-content for CWSN, etc. , to enable multimodal access to the educational content and resources (Desk, 2020).

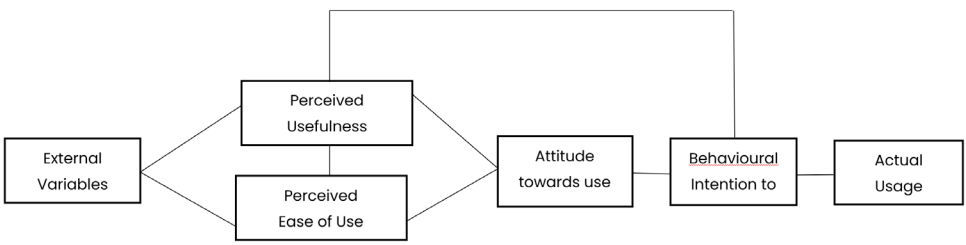
Built upon an open-source platform, namely Sunbird, Digital Infrastructure for Knowledge Sharing, popularly known as the DIKSHA platform, is a key digital Platform Infrastructure (DPI) initiative under PM eVIDYA, that enables the accessibility of e-textbooks, teaching-learning resources, and course materials through an online portal and mobile application for teachers and students (MoE, GOI, 2021; Singal, 2023). DIKSHA features digitized NCERT textbooks and over 2.43 lakh teaching resources contributed by academicians. It offers multilingual access in 18 languages, enabling widespread reach of the educational content in the nation. To further enhance the educational experience, India's National eGovernance Division (NeGD) under the Ministry of Electronics and Information Technology (MeitY) is also planning the integration of the Personalized Adaptive Learning (PAL) system within DIKSHA. PAL is based on utilizing AI algorithms to create an individualized learning path that is responsive to the needs and abilities of each student. Integration of PAL into DIKSHA has the potential to significantly improve student learning outcomes and engagement (Porecha, 2023). However, the success of the initiative depends on the acceptance and adoption of the platform among the targeted users.

While DIKSHA holds promises to expand access to high-quality educational content, it is also essential to understand how teachers are interacting with and adopting this platform. Successful implementation of any educational technology requires the acceptance and utilization by teachers, who are the critical conduits for translating improved educational technologies into actual learning outcomes. Thus, this paper applies the Technology Acceptance Model (TAM) to analyse the perceptions of Delhi government school teachers regarding the DIKSHA platform.

Introduced by Fred Davis in 1989, the Technology Acceptance Model (TAM) provides a robust framework for understanding user adoption and acceptance of information technologies (Davis, 1989; Shrestha et al., 2021). TAM is one of the most widely used theoretical models in technology adoption research. TAM was adapted from the Theory of Reasoned Action (TRA) which identifies perceived usefulness (PU) and perceived ease of use (PEU) as the two key determinants of technology acceptance (Davis et al., 1989; Chen et al., 2011). The model consists of five variables which are perceived usefulness (PU), perceived ease of use (PEU), attitude towards use, behavioural intention to use and actual usage. Out of these five variables, perceived usefulness and perceived ease of use, in combination with the variable attitude towards the use of technology, frame the core variables of the TAM model, whereas behavioural intention and actual usage are considered outcome variables (Shrestha et al., 2021; Chen et al., 2011). The variable Perceived Usefulness refers to the degree to which a user believes that using a particular technology would enhance their job performance (Davis et al., 1989). In the context of the present study, it refers to the degree to which teachers believe that using the DIKSHA app enhances their teaching effectiveness, supports student learning, and improves overall educational outcomes. The variable Perceived Ease of Use refers to the extent to which users believe they can effortlessly use a technology tool (Davis et al., 1989). In the context of the present study, it refers to how teachers find the DIKSHA app simple, intuitive, and free from technical issues, making it easy to navigate and use as a teaching tool. The variable Attitude towards using

DIKSHA refers to the overall positive or negative feelings that teachers have towards using the DIKSHA app in their teaching practices, reflecting their enthusiasm and satisfaction. The variable Behavioural Intention helps in identifying the likelihood or intention of teachers to continue using and recommending the DIKSHA app, reflecting their motivation to further explore, improve, and advocate for its use. The variable Actual Use refers to the frequency and consistency with which teachers actively engage with the DIKSHA app in their teaching activities, including resource access, using its different features, and encouraging student participation.

Figure-1: TAM Model for analysing the Actual use of the DIKSHA Platform



Source: Technology Acceptance Model (Davis et al., 1989)

Studies have suggested that the experience of using technology can influence the adaption of the technology among users (Abdullah & Ward, 2016; Alfadda & Mahdi, 2021; Alismaiel et al., 2022). Thus, this paper utilises Familiarity with the DIKSHA platform and the Frequency of using the DIKSHA Platform as external variables to analyse government teachers' perception of the DIKSHA Platform. The paper comprises the following research questions to study the perceptions of government school teachers using the TAM model:

1. Is there any relation between the Perceived Usefulness, Perceived Ease of Use, Attitude and Behavioural Intention for using the DIKSHA application in schools among the Delhi government school teachers?
2. Is there any relation between familiarity with the DIKSHA platform and TAM variables?
3. Is there any relation between the frequency of using the DIKSHA platform and TAM variables?

Review of Related Literature

Nair and Mukunda Das (2012) investigated the attitudes of high school mathematics teachers in Kerala, India, towards using Information technology (IT) as a tool for instruction by employing the TAM model. The study revealed that TAM was a suitable framework for studying the attitude of teachers towards technology acceptance. The study also indicated that the teachers' perceived ease of use of IT significantly influenced their perception of its usefulness and overall attitude towards incorporating IT into their teaching practices. Haleem et al. (2022), in their review paper, provided an insightful overview of how digital technologies can help transform classrooms and improve educational outcomes. For teachers, it may reduce the burden by automating regular tasks such as attendance

marking, performance monitoring, etc., whereas for students, it may help them to develop self-study habits by providing a customised learning experience. It is also highlighted that if technology is thoughtfully incorporated into learning, then it can serve various benefits to the future of education. Kampa, (2023) applied a m-learning readiness scale based on TRAM (Technology Readiness and Acceptance Model) among the open and distance learning students in India, in which it was revealed that optimism and innovativeness contribute to perceived ease of use (PEU), perceived usefulness (PU) and user adoption of m-learning positively. On the other hand, discomfort and insecurity negatively impacted the PEU. It was suggested that the m-learning can be utilised in the ODL environment. Muralidharan et al. (2019) demonstrated in their study that personalized and technology-aided instruction enhanced the learning outcomes for middle school students in India. The academically weaker students had shown improvement in their performances in this after-school instruction programme. The results highlighted that a well-designed edtech programme can improve the delivery of education. Jafar et al. (2023) conducted a study in the Tamil Nadu region and concluded that although government initiatives have improved online education access, there are still many students, especially in rural areas, who lack digital resources. It was suggested that the government should prioritize projects like distributing laptops/tablets/mobile devices to the marginalized students and teachers should be trained to adapt to remote and blended teaching-learning approaches. Ghosh, (2022) explored the DIKSHA application as an e-resource for ELT teachers across different KVs in India and found that DIKSHA serves as an invaluable resource for KV ELT teachers by giving them access to training materials, e-content (video lessons, PDFs, MCQs, and interactive exercises), and various teaching-learning aids. However, various limitations, such as technical glitches, the need for frequent app updates, and interface issues, also emerged in the study.

Methodology

This study is based on a descriptive research design that was found appropriate for obtaining perceptions from the population and examining factors that influence government school teachers' adoption of the DIKSHA platform using the Technology Acceptance Model (TAM). The target population for this study consisted of all the government school teachers in Delhi. The list of the region-wise Delhi government schools was obtained from the website of the Education Department Govt. of NCT of Delhi (Govt. of NCT of Delhi, 2024). In this list, schools were divided into East Delhi, North-East, North, North-West, West Delhi, South West, South Delhi, Central Delhi and South East regions. The researcher randomly selected three regions (West, North-West and South-West regions of Delhi) out of the 09 regions given in the list using the random number generator on Google. A simple random sampling method was employed to select eight government schools from the selected regions. This method helped in mitigating the sampling bias and ensured that the sample was not skewed toward teachers already familiar with DIKSHA. The responses were collected using a Google form, which was circulated after getting permission from the head of the schools. A total of 71 responses were received which comprised the sample for the study. A Likert Scale, which consisted of questions related to the DIKSHA application was developed. The questionnaire was divided into three sections. The first section consisted of questions related to

the demographic profile of government school teachers. The second section had questions related to familiarity with and general usage of the DIKSHA Platform. The third section consisted of 25 items related to all five constructs (PU, PEU, attitude, intention and actual use) of TAM (Alfadda & Mahdi (2021); Davis (1989)). The responses for the third part of the questionnaire were recorded through a five-point Likert Scale (Strongly Agree, Agree, Neutral, Disagree, Strongly Disagree). Two experts from the field of educational technology reviewed the instrument to establish the validity of the content of the questionnaire. Based on their feedback, minor modifications were made. Afterwards, a pilot test of the questionnaire was done on 25 government school teachers from Delhi State. The average response time to complete the questionnaire was recorded to be 15 minutes. The questionnaire had a Cronbach's alpha of 0.965 which displayed high reliability.

Results

Table 1 represents the demographic background of the participants. Most of the school teachers (90.1 per cent) in the study were female. 52.1 per cent of teachers were having 1-10 years of experience in teaching. The majority of the teachers were teaching at the secondary level (56.33 per cent) in Delhi government schools.

Table-1: Demographic background of the participants (n=71)

	N	Percent
Gender		
Female	64	90.1
Male	07	9.9
Teaching Experience		
1-10 Years	37	52.1
11-20 Years	22	31
21-30 Years	11	15.5
More than 30 Years	01	1.4
Teaching Level		
Primary	19	26.8
Middle	12	16.9
Secondary	40	56.33

In Table 2, 59.2 per cent (n= 42) of participants said that they are familiar with the DIKSHA Platform. However, the usage of the DIKSHA platform is relatively low among the participants. 38 per cent of the participants reported that they rarely use it, while 35.2 per cent reported that they use it in a month. Only

2.8 per cent said that they use it daily. A large majority (91.5 per cent, n=65) felt that the content available on DIKSHA is well-aligned with the curriculum of Delhi government schools. Over 80 per cent of the participants (n=58) had completed at least one Nishtha training module through the DIKSHA Platform. More than half (69.01 per cent) of the participants had said that they easily accessed the Nishtha training modules via DIKSHA. However, a majority also claimed (53.5 per cent, n=38) that they had not received any formal training to use the platform.

Table-2: DIKSHA Usage among School Teachers (n=71)

Statements	N	Per cent
Familiarity with the DIKSHA Platform		
Yes	42	59.2%
No	29	40.84%
Frequency of using the DIKSHA Platform		
Daily	02	2.8%
Weekly	11	15.5%
Monthly	25	35.2%
Rarely	27	38%
Never	06	8.5%
Received formal training to use the DIKSHA Platform		
Yes	33	46.5%
No	38	53.5%
Alignment of the DIKSHA Platform with the Curriculum		
Yes	65	91.5%
No	06	8.45%
Have you ever accessed any Nishtha training offered through the DIKSHA platform?		
Yes, I have completed multiple trainings	43	60.6%
Yes, I have completed at least one training.	15	21.1%
No, I have not participated in any training	13	18.30%
Are Nishtha Trainings easily accessible on the DIKSHA platform?		
Yes	49	69.01%
No	10	14.1%
Not Sure	12	16.9%

For understanding the relationship among the TAM constructs (perceived usefulness (PU), perceived ease of use (PEU), attitude toward use, behavioural intention to use (BI), and actual use (AU)), Pearson correlation coefficient (using SPSS) among these constructs was applied. Table 3 revealed that PU and PEU had a high positive correlation with the Attitude (PU= 0.748; PEU= 0.721) and BI (PU= 0.738; PEU= 0.715). Additionally, BI also displayed a positive correlation with AU (r = 0.745). Attitude demonstrated the highest correlation with AU (r =.824). All correlations were significant at the p<.01 level.

Table-3: Correlation among the Constructs

Constructs	Mean	S.D.	PU	PEU	Attitude	BI	AU
PU	3.7915	.50533	1				
PEU	3.6845	.60063	.686**	1			
Attitude	3.6958	.54810	.748**	.721**	1		
BI	3.6676	.55749	.738**	.715**	.786**	1	
AU	3.5268	.63807	.689**	.708**	.824**	.745**	1

***Correlation is significant at the .01 level (2-tailed)*

Table 4 shows the correlation between familiarity with the DIKSHA Platform and the constructs of TAM. The variable, Familiarity with DIKSHA showed a moderate positive correlation with perceived usefulness (r=.363, p<.01). This suggests that the teachers who were more familiar with the platform tended to view it as more useful for their teaching.

Table-4: Correlation between Familiarity with DIKSHA and TAM variables

Variable	PU	PEU	Attitude	Intention	Actual Use
Familiarity With DIKSHA	.363**	.214	.146	.257*	.121
	71	71	71	71	71

***Correlation is significant at the .01 level (2-tailed)*
**Correlation is significant at the .05 level (2-tailed)*

The variable, Frequency of using DIKSHA revealed stronger positive correlations with all TAM constructs (Table 5). The variable had a positive correlation with PU (r=.403, p<.01) which indicated that the participants who frequently used this platform perceived it useful. The variable also had statistically significant correlations with PEU (r=.294, p<.05), attitude (r=.285, p<.05), intention (r=.377, p<.01), and actual use (r=.349, p<.01). Thus, it can be said that the frequency of using DIKSHA positively impacts the perception, actual usage and adaption of the DIKSHA platform among the school teachers.

Table-5: Correlation of Frequency of Using DIKSHA Application with TAM variables

Variable	PU	PEU	Attitude	Intention	Actual Use
Frequency of using DIKSHA	.403**	.294*	.285*	.377**	.349**
	71	71	71	71	71

***Correlation is significant at the .01 level (2-tailed)*
**Correlation is significant at the .05 level (2-tailed)*

It is evident from Table 4 and Table 5 that the Frequency of using the DIKSHA platform had a slightly higher correlation with other variables of TAM when compared to familiarity with the platform. This suggests that regularly using the DIKSHA platform had a greater influence on improving the perceptions of teachers towards its usefulness, ease of use, fostering positive attitude, intention to use and driving actual adoption of the technology in the classrooms.

Findings & Discussions

The findings of the study align with the existing literature, which emphasized that perceived usefulness and ease of use significantly influence the attitudes, intentions, and actual usage behaviour of a user in a TAM model (Abdullah & Ward, 2016; Buabeng-Andoh, 2018; Davis et al.,1989; Shrestha et al., 2021). Table 2 revealed that while many teachers are using DIKSHA to some degree, they still face barriers such as limited familiarity, infrequent usage, and difficulty in accessing training content. These findings are consistent with Jafar et al. (2023), who found that even with government-led digital initiatives, a lack of digital resources and inadequate training continue to hinder effective technology use, particularly in rural and under-resourced areas.

For the first research question, a strong positive correlation (Table 3) was found between Perceived Usefulness and Perceived Ease of Use (r=.686, p<.01), which indicated that teachers who perceived DIKSHA as easier to use also found it a more useful tool. This aligns with the findings of Nair and Mukunda Das (2012), who noted that perceived ease of use significantly influences the perception of teachers regarding technology's usefulness and their overall attitude toward its adoption. In this study, teachers who perceived DIKSHA was useful had a more positive attitude, greater intention to use, and higher actual usage of the platform (Granić, 2022). It suggested that simplifying the platform interface and fostering positive attitudes by demonstrating the benefits of this platform could enhance its massive adoption among teachers. Haleem et al. (2022) also highlight that reducing technical burdens for teachers, such as simplifying platform navigation and automating routine tasks, can foster positive attitudes and increased intention to use digital platforms.

Similarly, teachers who expressed greater intention to use DIKSHA displayed higher usage behaviour (r=.745, p<.01). However, this relationship was slightly weaker than for attitude, which also suggests that intention alone may not translate fully into actual adoption without a supportive attitude. This finding is in line with the insights of the study conducted by Kampa (2023) on m-learning, in which it was found that user optimism and ease of use were essential for the adoption of the technology. PU, PEU, attitude and intention were found to be significant positive predictors of actual usage behaviour among the participants. Thus, it can be said that

TAM is a valid framework to predict the acceptance and usage of DIKSHA among school teachers.

Regarding the second research question, familiarity with the DIKSHA Platform (Table 4) had a moderate positive correlation with the variable Perceived usefulness and Behavioural Intention of using the platform. Ghosh (2022) highlights that the teachers in Indian KVs value DIKSHA for its e-resources, yet they struggle with technical issues and a need for regular updates, underscoring that familiarity alone is insufficient to drive adoption These findings also suggest that familiarity with DIKSHA is important, it must be coupled with frequent, hands-on experience to strengthen PU, PEU, and related behavioural intentions.

For the third research question, the frequency of using DIKSHA (Table 5) had a positive correlation with all the constructs of TAM. Thus, it can be said that the greater familiarity with DIKSHA appears insufficient on its own to fully improve acceptance based on the TAM Model. However, increased frequency of using the platform/ experience with the technology has stronger ties to enhancing PU, PEU, attitude, behavioural intention and actual usage. These findings are supported by Muralidharan et al. (2019), who reported that continuous engagement with technology-aided instruction can lead to improved learning outcomes, especially for students. Moving teachers from basic familiarity to regular use could therefore be key to technology acceptance, as sustained usage has been linked to better-perceived benefits and enhanced acceptance of digital tools (Buabeng-Andoh, 2018). As Haleem et al. (2022) and Ghosh (2022) both highlight ongoing support, training, and access to resources are critical for ensuring long-term engagement of teachers with educational technology.

These findings indicate that moving teachers from basic familiarity to repeated and regular hands-on use of DIKSHA is key to supporting technology acceptance and improved perception. Thus, providing more training, incentives and support to increase repeated usage could positively influence TAM constructs and improve the adoption of the DIKSHA Platform.

Conclusion

This study explored the perception of Delhi government school teachers towards the DIKSHA Platform using the Technology Acceptance Model. The findings suggest that simplifying the DIKSHA interface and providing hands-on training to teachers can significantly improve its acceptance among teachers. The study implies that policymakers should allocate more resources to train stakeholders and increase investment in the development of the digital education infrastructure. The policymakers may also consider making guidelines for rewarding the stakeholders who regularly utilize DIKSHA by introducing gamification elements such as implementing a badge system or levels to further engage and motivate the users. At the school level, conducting regular training for teachers and improving the accessibility of the DIKSHA platform should be prioritised. The schools should also recognise and provide real-time technical support to the teachers. Teachers should also proactively participate in professional development activities to build their technological competence. Teachers can enhance collaboration and contribute to the development of high-quality e-content by engaging with online communities and partnering with educators from across the nation. The platform developers should strengthen the inbuilt feedback and real-time technical

glitch-addressing system. This feature can instantly solve the problems faced by teachers and students.

The study had various limitations related to sample size, variables and geographical location. With a sample size of 71 teachers, this study serves as a preliminary investigation. Future studies could build upon these findings by using a larger, more diverse sample for enhanced generalizability and more robust statistical analyses, such as regression and correlation. The studies may also utilise qualitative insights by incorporating Interviews, Focused Group Discussions, etc., to provide a comprehensive analysis of the perception. Future research may also benefit from incorporating other technology adoption determinants, such as social influence, self-efficacy, and privacy concerns. The studies can explore the extended versions of the TAM Model to observe the impact of subjective norms and other psychosocial variables on the perceived usefulness of the DIKSHA platform and its actual adaptation. The researchers can also take comparative studies among DIKSHA and various private edtech tools available in the market and can provide useful insights. Overall, this study had important implications for stakeholders in improving the adoption and utilization of the DIKSHA platform among teachers to ultimately enhance learning outcomes through digital platforms.

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Appendix

The Questionnaire

- Gender (Male/Female)
- Teaching Experience (1-10; 11-20; 21-30; More than 30 Years)
- Teaching level ((Primary; Middle; Secondary)

Usage of DIKSHA among School Teachers

- Are you familiar with the DIKSHA platform for teaching and learning purposes? (Yes/No)
- How often do you use the DIKSHA app for accessing educational resources and content? (Daily; Weekly; Monthly; Rarely; Never)
- Have you received any formal training or support to effectively use the DIKSHA app in your teaching? (Yes/No)
- Have you ever accessed any Nishtha training offered through the DIKSHA platform?
- Are Nishtha Trainings easily accessible on the DIKSHA platform?

Perceived Usefulness

1. Using the DIKSHA app significantly enhances my teaching effectiveness.
2. The educational content available on DIKSHA is valuable to me.
3. Accessing resources on DIKSHA positively impacts the learning outcomes of my students.
4. The app makes it easier to explain complex concepts to my students.
5. DIKSHA content enhances the educational experience for my students.

Perceived Ease of Use

6. The interface of DIKSHA App is user-friendly
7. I find it convenient to access content on the DIKSHA app.
8. The instructions provided within the app are clear and straightforward
9. I can easily participate in Nishtha Training Modules within DIKSHA Application
10. I don't encounter technical difficulties when using DIKSHA

Attitude

11. I enjoy using DIKSHA for teaching and learning.
12. DIKSHA is a valuable addition to my teaching toolkit.
13. I look forward to exploring new features and content on DIKSHA
14. I have a strong preference for using DIKSHA over other educational platforms.
15. I am enthusiastic about incorporating DIKSHA into my classroom activities

Behavioural Intention

16. I would recommend DIKSHA to my colleagues
17. I want to attend training sessions to improve my use of DIKSHA
18. I look forward to contributing my own content to DIKSHA

19. I am open to collaborating with other educators through the DIKSHA platform
20. I intend to continue using the DIKSHA app in my teaching

Actual Use

21. I frequently log in to DIKSHA to access educational resources
22. I actively seek out new materials on DIKSHA Application for my classes
23. I consistently engage with DIKSHA's features and tools
24. I encourage my students to use DIKSHA for learning outside of school
25. I contribute to the DIKSHA platform by uploading my teaching resources.

Research Article

Learning-by-Teaching based Framework for Flipped Classroom

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Abstract

Flipped Classroom has emerged as a promising instructional innovation, and academia shows a keen interest in research related to it, as evidenced by the spurt in related studies. Simultaneously the experts and the research community caution against the flipping of the classroom with an unfounded belief that it is simply a matter of reversal of the roles of the students and teachers at home and in class without due consideration of the theoretical aspects of the flipping process. Researchers recommend using empirically validated design models when shifting their classroom from the traditional to the flipped structure. However, there is a need to boost the research related to the Instructional Design Model for a flipped classroom since such studies are quite rare Vis the growing literature on Flipped Classroom. The present study, a part of a broader funded project to validate an Instructional Design Model for a Flipped Classroom in a Teacher Education Institute in India, proposes a prospective framework to design a flipped classroom based on the theoretical inputs frequently identified in the related literature synthesized with the theory of learning by teaching. The instructional model developers or designers and the teachers are the prospective audience of the proposed framework. The framework is robust and can be used across various disciplines. The framework is, in particular, relevant to those disciplines that demand frequent application of the knowledge and skills in practical situations like that of pre-service teacher programs.

Keywords: Filliped learning, Self-learning, Collaborative learning, learning by teaching, Instructional Framework

Introduction

Flipped Learning (FL) as a blended format for classroom learning is a 'transformative' and innovative 'pedagogical' approach wherein "direct instruction moves from the group learning space to the individual learning space, and the resulting group space is transformed into a dynamic, interactive learning environment where the educator guides students as they apply concepts and engage creatively in the subject matter." (Flipped Learning Network (FLN), 2014). FL is believed to achieve the educational goals of collaborative, communication, creativity, and critical thinking skills (Jacqueline, 2015; Long et al., 2017; leRoux & Nagel, 2018; Zhao et al., 2021; Padugupati et al., 2021) even though certain studies reported no effect of FL on students' performance (Akcayir & Akcayir, 2018; Yin & Leighton, 2020). However, the studies unanimously reported learners' satisfaction with the engaging experiences created in the flipped format of learning (Almodaires et al., 2018) with greater control of their learning in the asynchronous phase, (Shao & Liu, 2021).

Recently there has been a spurt of interest in flipped learning-related instructional design models and frameworks (Lee et al., 2017; Hastuti

et al., 2022) as a "systematic tool..... in understanding related instructional variables" (Lee et al., 2017, p. 434), as a guide for designing a flipped class, and as a valuable resource for the teachers willing to flip their classroom in the true sense (Lo, 2018; Lawson et al., 2019) across all disciplines including that of teacher education (Almodaires et al., 2018; Cabero-Almenara et al., 2021; Candas & Altun, 2023). The primary author of this paper, a teacher, has been using the presentation of course-based content by the students as an instructional strategy for a long time in undergraduate and postgraduate programs. This strategy is linked directly to the theory of learning by teaching. However, integrating the principle of learning-by-teaching in flipped learning frameworks is underrepresented in the literature. This paper is embedded in the theoretical premises related to instructional design models for a flipped class and the operationalisation of learning by teaching. The purpose of the paper is to identify the core principles of flipping the class particularly those related to the pre-class learning space, the in-class learning space and the principles related to the synthesis of the two learning spaces. A thematic review of the literature was done using ERIC and SCOPUS databases along with Google Search to achieve the purposes. The analysis of the literature was done to identify the key principles that were synthesized to ideate a prescriptive framework to model the flipped class.

Structure of Flipped Classroom

Flipped learning marks a paradigm shift in the structure of the learning space. There is a minimum of two learning spaces, viz., the asynchronous online learning space called the pre-class learning space (PCLS) and the synchronous face-to-face actual classroom learning space or the in-class learning space (ICLS) (Diningrat et al., 2023). Some researchers include a third learning space as an asynchronous post-class learning space (PoCLS) (Ma et al., 2018; Chiang & Wu, 2021; Xiao, 2022).

Intentionally, the PCLS aims at achieving lower-level learning outcomes. The in-class and post-class learning spaces aim at achieving higher-level complex learning outcomes. Functionally, the two spaces have different roles and responsibilities for the teacher and the students (Crișan & Albulescu, 2018). The presentation and lecturing aspects of the conventional classroom are assigned as self-learning tasks in the PCLS. The basic knowledge and understanding related to the content are meant to be self-learned through self-regulation by the students at their own pace. The teacher provides the learning resources in variegated forms for self-learning. The in-class time thus spared by shifting the learning of the basics in the PCLS is used to engage students in complex learning tasks involving collaboration, communication, and problem-solving skills in the ICLS (Lee et al., 2017; Li et al., 2020; Zhao et al., 2021; Diningrat et al., 2023).

A third component in the structure of a flipped class is the Integration component. Integration refers to some instructional task(s) that can help the learners link their learning in the PCLS and the ICLS. Further, the design decisions for FL are well informed by the learning theories and principles.

Principles Guiding Pre-class Learning Space

Behaviourism and Cognitivism are the overall theoretical inputs into the design of PCLS (Lo, 2018; Diningrat et al., 2023), emphasizing knowledge acquisition and retention. The principle of self-learning informs the PCLS design decisions (Zainuddin & Perera, 2018; Kim et al. 2021) and is considered a significant

determiner of the effectiveness of learning in the ICLS and PoCLS (Sletten, 2017; Huang & Hew, 2021; Kim et al., 2021). Self-learning is key to promoting self-regulation capabilities among the learners where self-regulation is defined as an active learner initiative to "monitor, regulate and control their cognition" (Pintrich, 2000).

Another theoretical input is the principles of multimedia instruction (Mayer, 2014) based on the Dual Coding Theory (Clark & Paivio, 1991). It asserts that the retention of learning is directly related to the use of multiple channels in communication. Mayer recommends presenting the learning materials (in the PCLS) through different channels of communication (audio, visual and textual) making the materials more accessible to the students according to their preference for learning modality (Capone et al., 2017; Lage et al., 2000) along with graphical representations (Concept Maps for example) in several cases (Kaye & Kim, 2023) providing greater flexibility for learners to choose their preferred modality (Yasar & Polat, 2021). Video Lectures (VL) are invariably used as a learning resource in the PCLS (Arslan, 2020).

VLs are flexible learning resources that allow learners to stop and play at their own pace and time (Xiu et al., 2019). Further, VLs make learning interactive through embedded quizzes as perceived by the students (Scagnoli et al., 2019) and increase their learning motivation (Tse et al., 2019). The video and text materials as learning resources are prepared following the principles of Segmentation, Personalization, and Signaling (Mayer, 2014). The complexity and size of the learning material are recommended to match the ability of the learner to process the materials i.e. the cognitive load that the students can handle (Mayer et al., 2003). The VLs are consequently, chunked to make them manageable for the students and sustain their learning motivation (Crawford & Senecal, 2017; Lee et al., 2017; Petre, 2020). The video lectures and textual materials are presented using personalized ways of communication and employ different ways to highlight the key ideas in the learning material (Zainuddin & Attaran, 2016; Lo, 2018). Personalized communication in the PCLS is believed to compensate for the actual presence of the teacher. Signalling, or highlighting the key ideas in the learning materials helps the learner retain the learning material for a longer time.

Principles Guiding In-class Learning Space

The raison d'etre of the flipped class is to create more time and space for students' active engagement. The actual face-to-face time and space spared by the asynchronous PCLS is used to engage students in deep learning tasks and active knowledge construction. Accordingly, the constructivist perspective in general and social constructivism in particular inform the design of learning tasks in the ICLS (Yelamarthi et al., 2016). Constructivism is a woolly term (Woolfolk, 2013) that includes any activity or method that promotes students' construction of knowledge in an active and engaged manner. Constructivism presents learning as a meaningful engagement of the learners.

An important principle guiding the design decisions for ICLS is the Principle of Active Engagement. This principle demands creating learning tasks that are engaging for the students. Students are engaged when they are interactively involved in the learning tasks. Students are involved in the learning tasks at the affective, behavioural, and cognitive levels in engaging learning tasks (Archambault et al., 2009; Fredricks et al., 2004). Collaborative learning

approaches, an operational implication of the social-constructivist perspective on learning, are frequently used in FL as an engaged learning task. The principle of CL thus advocates peer interaction and teacher-student interaction as a primary source for meaningful learning and knowledge construction. The collaborative interactions are significant for the development of critical social and communication skills ((Akçayır & Akçayır, 2018; Gomez-Lanier, 2018; Karabulut-Ilgu et al., 2018). The principle is translated during FL into peer collaboration and student-teacher collaboration. The collaborations are achieved through a range of learning tasks in the flipped class such as small group discussion (Gomez-Lanier, 2018; Lo, 2018; Arslan, 2020; Diningrat et al., 2023) project-based learning (Deng, 2018; Yin & Leighton, 2020; Hastuti et al., 2022), collaborative problem solving (Laoha & Piriyasurawong, 2018).

The principle of scaffolding is another important principle that underpins the design of ICLS. ICLS in the flipped class learning spaces redefines the roles and responsibilities of the teacher and learners. The students are promoted to self-learn, and the teachers are expected to guide and facilitate their learning. Scaffolding is temporary assistance by which a teacher helps the learner to know how to do something "so that the learner will be able to complete a similar task alone" (Gibbons, 2015). Scaffolding is an important responsibility for the teachers. Thus, the teachers are creators of learning tasks and facilitators of students' learning (Guo, 2019). In other words, the most significant role of the teacher is to provide scaffolds to promote deep learning. The scaffolds can take various forms during in-class learning, such as providing hints or prompts to students, giving feedback on their ongoing tasks, and responding to students' queries across all the learning spaces (Guo, 2019).

Principles related to Motivational Needs

Motivation is important to sustain students' active engagement in the learning task. Self-determination theory (SDT) (Cole et al., n.d.) is an important theoretical input for consideration in a flipped classroom (Lo, 2018). According to the SDT, autonomy, competence, and relatedness are the three significant psychological and cognitive needs that determine students' engagement. The principle of Self-learning (described above) addresses the need for autonomy in learning. The principles of student engagement and collaborative learning (described above) guide tasks that enable students to construct their knowledge. The principle of scaffolding (described above) infuses the sense of autonomy and belongingness with learning among the learners. Teachers' feedback is vital as a scaffold to steer students' movement along the learning path. It promotes self-efficacy among learners and boosts their confidence (Narendran et al., 2018). Teachers' feedback as a scaffold satisfies the motivational need for competence (Akçayır & Akcayır, 2018; Diningrat et al., 2023). The motivational need for relatedness is addressed through the provision of social interaction in the form of peer interaction and teacher-student interaction. The reviewed studies used a range of small-group collaborative learning tasks, such as solving a problem or completing a project (Chis &

Muntean, 2018) or small-group discussion tasks (Akcayır & Akcayır, 2018) based on the principle of Collaborative Learning. These interactions create opportunities for learners to associate with each other and with the learning task, fostering a sense of relatedness.

Principles related to the Integration of pre-class and in-class learning space

Integration of the learning and assessment tasks across the different learning spaces is an essential requirement for a flipped class (Lee et al., 2017; Wang et al., 2019). The link between different learning spaces is explicitly or implicitly established. Several principles are discernible and are used by researchers and designers to establish a link between the learning spaces in the flipped classroom.

The principle of objective clarification is used to relate, delineate, and communicate the objectives based on certain classification systems (Revised Bloom's Taxonomy, for example). The objectives, it is assumed, establish the links between the different learning spaces of the flipped class and consider the communication of information about the goals of learning and behavioural expectations from the students out of learning as a scaffold that can help the students see the link between the activities in the pre-class and ICLSs. Generally, the lower-level objectives in the taxonomy are used as the overall guide to design learning materials for the PCLS, and the higher-level objectives are used to guide the design of the ICLS (Yelamarthi et al., 2016; Guo, 2019; Hall & Lei, 2020; Sivakumar, 2023).

Further, learning is context-specific. The contextual learning theory suggests that "learning occurs only when students process new information or knowledge in such a way that it makes sense in their frame of reference" (Hull, 1995). The principle of Contextualizing Learning is employed in designing learning tasks that relate the theoretical knowledge and skills to be learned in the flipped classroom with the real-world problems wherein the knowledge and skills are to be used. Merrill, (n.d.) recommended the inclusion of some problems as a context for learning since learning is promoted when the (a) learners solve real-world problems through (b) activation of prior knowledge and by providing an opportunity for learners to (c) demonstrate their knowledge, (d) apply knowledge and (e) integrate knowledge (Hall & Lei, 2020). Thus, learning is contextualized in some real-life problems that can help the students integrate, organize, and translate their learnings in real-world situations (Donaldson, 2017; Hall & Lei, 2020) enabling them to see the learning tasks in different learning spaces as linked and associated (Hall & Lei, 2020; Park & Suh, 2021; Rusnayati et al., 2023).

Another important idea, relevant to FL is the concept of Just-In-Time-Teaching (JiTT). JiTT is a pedagogical technique (Novak, 2011; Novak & Patterson, 2010) that acts as a feedback loop. In a flipped classroom, the JiTT "creates a direct link between the pre-and in-class activities" (Rowley & Green, 2015, p. 15). As the name suggests, it is meant to provide a situation in which the student can demonstrate their learning, and based on their response, some further learning tasks are introduced immediately to overcome their misconceptions or any lacuna in their learning. JiTT, in the context of the FL, consists of 'JiTT exercises' in the PCLS and a 'JiTT response' in the ICLS (Rowley & Green, 2015, p.15). The JiTT exercise frequently includes a video-embedded quiz and an overall quiz based on the learning materials presented in the PCLS. In these exercises, students usually have to read, watch, or carry out an activity and then answer questions related to the task. The students' performance on the JiTT tasks in the PCLS (often in the form of video-embedded quizzes, writing the summary of the video lectures or text materials etc.) are used as learning analytics by the teacher to identify topics or problems for group activities in the ICLS. These tasks based

on the students' learning analytics are thus used as a JiTT Response in the ICLS (Rowley & Green, 2015; Lee et al., 2017; Shiau et al., 2018). JiTT tasks based on the learning materials (video lectures and reading text materials) in the PCLS are more engaging and interactive.

Principle of Learning by Explicit Teaching

The idea of involving students in teaching tasks evolved out of the general theory of Learning by Teaching (LbT) by Jean-Paul Martin (Stollhans, 2016). LbT is considered a strategic way to engage students in complex cognitive tasks following the social and developmental learning theories and can be achieved in variegated forms (Grzega & Schöner, 2008; Chis & Muntean, 2018; Gao & Wang (2019) consider it as an active learning strategy since the students learn to verbalize. Since it involves active student engagement in knowledge organization, presentation, and clarification, it is deemed a constructivist strategy. Teaching experience provides richer learning experiences to the learners. It provides opportunities for learners to reflect on their understanding.

LbT acquires a range of forms. One of the earliest forms of learning qualified as LbT is peer tutoring in which individuals in a cohort learn by teaching each other (Goodlad and Hist, 1989; Topping, 1996; Duran, 2017). Collaborative peer group tasks (for example think-Pair-Share Task) are another form of LbT. In this case, the peers in the groups interact and teach each other.

However, teaching in such contexts is implied, and hence, this form of LbT is termed in this paper as Learning by Implicit Teaching. A corollary phrase is coined viz Learning-by-Explicit-Teaching (LeT) by the authors to designate the learning tasks that involve students in preparing, presenting (or explaining), and clarifying a given content in the class in the form of mini-lectures. The rationale for the term emanates from the assumption that greater cognitive processing is involved when the student learns to explain or present for others (peers in this case) than when the student learns for himself or herself (Fiorella & Mayer, 2013; Duran, 2017; Stollhans, 2016). Teaching, as a LeT task, is approached by the students as a problem, and solving the problem includes preparing and presenting the content that, in turn, promotes their learning (Merrill, 2002; Stollhans, 2016; Hall & Lei, 2020; Yin & Leighton, 2020).

LbT is consequently assumed to be a potential theoretical input in the overall framework for FL. An initial activity recommended by several researchers in the ICLS is the mini-lectures for the activation of prior knowledge and as a link between the two spaces of learning (Talbert, 2017). The proposed framework capitalizes on the attached significance of mini-lectures in the classroom and the opportunities for self-regulated learning (in the PCLS) to transform the mini-lecture into a student activity in the form of LeT based on the theory of LbT (Crouch & Mazur, 2001; Stollhans, 2016). Finally, the evaluation of the LeT task provides a sort of analytics on learning that the teacher can use in the small group collaborative learning tasks for the ICLS and helps in the remediation of learning errors.

Synthesis of the Principles: APPLE Framework for Flipped Class

The innovative framework for flipping the classroom (A-P-P-L-E) in Higher Education is rationally proposed through a juxtaposition of the various principles identified through a review of the literature and the additional principle of learning by explicit teaching.

Assimilation: Flipped Class includes the PCLS and the ICLS. The PCLS involves assimilating the basic knowledge and

skills related to the target content through self-paced and self-regulated learning. This stage is appropriate for achieving the lower level cognitive goals like knowing and understanding. Video lectures with embedded quizzes, reading materials, and references for further reading are plausible learning materials used in this phase. The embedded quiz and/or some overall assessment task (taking notes, writing a summary or even a quiz) can be used as the JiTT exercise in the PCLS.

Preparation and Presentation: It is a small group learning task. A small group of students from the larger cohort is assigned a teaching task in each cycle of the flipped class. Each cycle of flipped class can be a weekly cycle. The learning task includes preparing a small chunk of the content for presentation in the ICLS. The presentation is a mini-lecture. The role of the members in the small group in each teaching task is pre-decided. The preparation phase of the LeT task is completed in the PCLS in collaboration with the teacher. The presentation phase is carried out in the ICLS as the initial activity of each cycle of the flipped class. The presentation is done for the whole class. It is followed by an interactive question-answer session for the class with the teacher as the moderator.

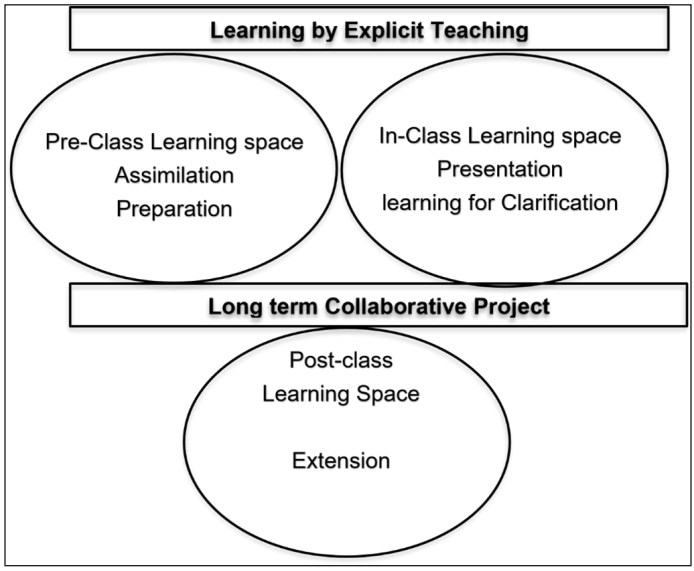
The teaching task as described above helps in the activation of the prior knowledge among the students. It also prepares the background for peer group interaction. The interactions following the teaching task provide feedback on students' learning. Further, the teacher uses the feedback to create different in-class group learning tasks.

Learning for Clarification: Misconception is a common event in any learning situation. The learners in the ICLS work collaboratively to identify and remedy their misconceptions or learning errors. The time and space of ICLS are used to address the students' misconceptions and to expand their cognitive processing. The teacher can analyze the students' presentations in conjunction with the post-presentation interactions in the class and the student's responses to the quizzes in the PCLS. The analysis yields important data as additional input into the learning tasks in ICLS. The small-group learning tasks are completed collaboratively and hence help in the development of social skills. The collaborative learning tasks help enrich students' abilities and skills, including social skills, communication skills, and critical thinking skills.

Extension: The ability to use the learned concepts and skills in variegated real-life contexts is the raison d'etre of all instructional efforts. The proposed framework advocates a problem-based assignment to be communicated to the students at the beginning of each cycle of FL. The problem is created by the teacher and shared with students in small groups. The students are expected to complete the learning task based on the learning achieved in the PCLS and ICLSs in small groups. A post-class learning space is thus visualized in which the students collaboratively complete the assigned task generally as a long-term project related to a unit/sub-unit of the course targeted in each cycle of flipped classes. Problem-based learning tasks are recommended and used by other researchers as well particularly for their potential to enhance the learning of low achievers (Chis & Muntean, 2018) and the general ability to foster critical thinking skills (Listiqowati et al., 2022). Further, if the problem task is provided in advance it serves as a context for the learners to integrate and organize their learning in the pre-class and ICLSs.

A representation of the framework ideated in this paper is presented in Figure 1.

Figure-1: APPLE Framework for Flipped Class



Concluding Remarks

Flipping the class is not merely a shift of the learning tasks in space and time. It is a matter of deliberation and planning. The design of FL is advocated to be supported by appropriate theoretical premises and the creation of a framework is the initial step towards adopting a flipped learning approach. Several frameworks have been proposed recently. The ADDIE framework was used to develop and validate the instructional design model for flipped learning (Lee, Lim and Kim, 2017). Similarly, the Flipped Learning Wheel Framework was developed with a focus on collaborative learning and peer feedback (Luo, et al, 2020). The Apple framework proposed in this paper is unique in that it integrates the principle of learning by explicit teaching with the established principles of flipped learning.

The salience of the proposed framework to innovative instructional practices is substantiated by the opportunities for learners (one small group at a time) to engage in deep learning through the preparation and presentation learning task and is thus in compliance with the nature of the constructivist class. The framework also creates opportunities through the collaborative project to apply their knowledge in real-life situations. The framework is useful for courses that demand the application of learned knowledge and skills in a real-world problem is desirable. The general applicability of the framework in the context of all practical-based courses makes it a robust framework. Simultaneously, the framework is flexible enough to allow for changes in the format of learning tasks in the actual classroom situation as per the course requirement and the constraints of the educational situation. This flexibility makes it relevant across a wide range of disciplines and fields of study, with practical courses in their program of study. Nevertheless, the readers are expected to interpret the framework in light of the validity of the principles reportedly used in designing the Flipped Classroom and the notion of LeT.

The framework is based entirely on the review of the literature and the authors' personal experiences with Learning-by-Explicit-Teaching (LeT)

in their classrooms. The principles guiding flipped learning identified from the literature were synthesized with the notion of LeT to create the framework. The framework is prescriptive and its empirical validity is to be established through actual translation of the different phases into instructional tasks. The framework is a knowledge artefact and since it includes a technology-integrated approach to instruction, the contextual factors and the stakeholders' (students') perspective are important in translating the framework into instructional practice. Any instructional translation of the framework needs to be tested and retested, revised and refined through inputs from repeated piloting of the instruction based on the approach. Consequently, design educational research as a development research approach is the recommended method for instructional design for flipped learning based on the framework and validate the same (van Den Akker, 1997).

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Research Article

YouTube Educational Videos in Bridging the Learning Gaps among School Students

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Abstract

Videos have a long-term effect on learners. YouTube plays a major role in enhancing the learning of school students after school hours whenever they need to study at their own pace. When they learn from YouTube, the same concept can be explained by different teachers, and the best part is that they can learn at their own pace. YouTube acts as a complementary learning platform that fulfils the learning needs of learners with educational videos. The purpose is to find out the effects of YouTube educational Videos on learning among school students as Net Generation learners. The research is related to Educational Technology in which a questionnaire is prepared to ask general questions about YouTube and how YouTube educational videos help in studies and to improve the learning gaps, clearing doubts that arise in studies. Mixed Method Research design is used to conduct research. Both Quantitative and Qualitative methods are used to collect the data. A questionnaire is prepared, and data is collected through Google Forms. Semi-structured interviews are conducted to collect the data. The sample taken are school students from class 6th-8th. The major findings are that YouTube videos help school students fill their learning gaps by mobile learning using their mobile by doing self-paced learning, and videos have long-lasting effects on their learning.

Keywords: YouTube, Technology, Videos, Self-Paced Learning, Mobile Learning, Net Generation

Introduction

YouTube is a platform where videos can be shared and explored by the viewers. It is one of the most frequently accessed websites on the Internet (Chau, 2010). YouTube is a well-known video-sharing platform for uploading, sharing, and viewing video clips (Duffy, 2008). Its popularity increased day by day, and the boost-up period came during the lockdown itself. Researchers can see the boost so much that this portal changes into a community where people bond with peers, acquire new skills, explore, and engage in discourse activities of learning using this YouTube platform (Chau, 2010). The 21st century wants to stay connected in groups and wants to learn in groups rather than in isolation. Collaboration plays an integral role in net generation. The integration of emerging technologies helps create a community and collaboration that leads to the development of effective teaching models (Beldarrain, 2004). YouTube helps in creating groups and communities and thus leads to collaborative learning, which helps learners to collaborate with peers. Today's generation can be referred to as the Net- generation as they are very familiar with the Internet, its various features, and effective use of technology. Lockdown has had a significant influence on making learners tech-friendly and has opened the

doors for the successful integration of technology in education. The integration of technology is a boon for the effective teaching-learning process.

Background information

YouTube has a long history of being created, and how its popularity has increased so far that even students and small kids can be seen scrolling and using it as a medium to study. It was created in the year 2005. Although it has a long history of growth, it is so popular today that even laymen use this app for various purposes. History of YouTube Educational videos create an impact on students towards learning the content in a way that content retains for a longer period and is understandable. YouTube is a source of all types of content and learners can access content anytime according to their need and availability of time. YouTube acts as a complementary learning platform that fulfils the learning needs of learners with educational videos. As a platform that supports participatory culture, YouTube allows exhibition spaces that provide exposure that leads to recognition, feedback, and opportunities for collaboration (Chau, 2010).

Significance of the research

Chtouki. et al. (2012) YouTube has the greatest advantage as it is a free web-based service that provides short and relevant content and important concepts are there which are also taught in school. (Prensky, 2001) pointed out that "future content" as future content needs to be digital and technological to meet the needs of the learners. He suggests that learning new stuff using different ways is more important than learning anything, and YouTube plays an important role in it. This research helps to know exactly how much time learners spend on YouTube for educational purposes and the effects of videos on retaining the content for the long term. This research is helpful in exploring the importance and effects of YouTube educational videos among school students. The purpose is to explore the impact of YouTube on the mindset of school students and help in self-paced learning among learners. (Kohler, 2021) YouTube has great accessibility nowadays, and due to its low-barrier functions, this platform has a great advantage in transmitting scientific knowledge. Self-paced learning is very crucial in today's era to cater to the individual needs of the learners as they can learn anytime, anywhere, at their own choice. YouTube, as an educational platform, has the capability to promote self-paced learning among learners.

Research Objectives

- To explore the effectiveness of Videos in better learning.
- To what extent can YouTube educational videos help bridge the learning gaps among school students?
- Recognizing the effectiveness of YouTube videos can help in retaining the content for a longer period.
- To identify the effectiveness of YouTube educational videos to promote self-paced learning among learners.
- Research problems or questions
- To what extent do YouTube educational videos help in bridging the learning gaps among school students?
- Why are videos effective in better learning?
- How do YouTube educational videos help in retaining the content for a longer period?
- How do YouTube educational videos promote self-paced learning among learners?

Review of Related Literature

Much research has been done on the usage of YouTube for educational purposes. Chau (2010), YouTube acts as an intersection of media creation and social networking that provides young people with a participatory culture in which they can create and share original content in this era. According to Chau (2010), Participatory culture contains five major characteristics that are relatively low barriers to artistic expression and civic engagement, strong support for creating and sharing one's project, Informal mentorship, a belief that contribution matters, and a sense of social connection. (Duffy, 2008) YouTube and some other web 2.0 technologies play a significant role in education as an engagement tool among net generation learners. Roodt and Peier (2013) conducted Research on Undergraduate students to check out how YouTube can help in student engagement. Students' classes are being taken through YouTube for the whole semester, and at the end of the semester, a Questionnaire is filled out by the participants to explore the impact of YouTube videos on net-generation learners. Duffy (2012) points out that the new "Learning Ecology" is present where Web 2.0 plays a significant role in collaboration and creative evaluation. Research suggests some specific features of Videos to be an effective tool in the study and a semi-structured contributing factor in this. Jia (2019) has done an extensive literature review where the comparison of the benefits and limitations of YouTube videos in education is made. Otchie (2020) researched to find the answer to the question Can YouTube videos facilitate the teaching and learning of STEM subjects in high schools?. (Fleck, 2014) pointed out that blended learning theory and Information processing theory work towards the integration of technology in the classroom ,and it is a successful integration. Blended learning theory talks about the involvement and usage of Web 2.0 increases; instructors are using multimedia and different platforms in teaching. Elareshi & et al. (2022) made a hybrid analysis SEM-ANN-based approach in understanding students' academic performance by the adoption of YouTube for learning during Covid. The major findings from this research clearly show that respondents are willing to use technology, applications and support for the usage of YouTube in Academia. From all these studies, it is clear that YouTube has the potential to apply in education and act as a helpful aid to bridge the learning gaps among individuals.

Key theories or concepts

Kearsley and Shneiderman (1998) summarized the work and created an Engagement theory: A framework for Technology-based Teaching and learning. Engagement theory emphasizes on building a successful collaborative team to work on ambitious projects that help in meaningful learning outside the classroom. The three major components are Relate-Create- Donate required in activities that occur in groups, such as the creation of collaborative teams, project-based activities, and having an outside authenticity. P. Duffy (2013) suggests video learning should not be passive and suggests guidelines for using videos effectively as they contain various aspects that are essential for the effectiveness of video learning. These aspects include segment, notes, pause, sound off feature, picture off, preview, integration, cut, focus, and feedback. Segment allows students to watch the videos in small segments, not as a whole at a time. Note-taking is an important characteristic feature of videos. The video should be like that, which allows you to take notes and then rewind the video and check the notes,

whether individually or in a group, like a brainstorming activity. The pause feature suggests that the video should allow this feature to pause to memorize and recall any picture for better engagement. The sound-off feature is important and the best technique for listing out the steps of a process. Picture off feature focuses on the audio that audio clues are given, and prion is made. Previews suggest that each video should show the learning objectives of the lesson. The integration feature of video has features that will be able to integrate the experimental content into the conceptual knowledge. That feature allows the usage of online video editors to capture. The focus feature allows to enhance the focus of the student, starting the video with an activity that can be conducted to enhance meaningful learning. Feedback plays an important role in making the significance of the video and relating the video for long-term usability.

Gaps in the literature

Much research is being conducted in this area of the Educational field. Mobile learning and its impact on students' learning have been explored, as well as the side effects and usage of technology in education. This study focuses on identifying the importance of YouTube educational videos to fill the learning gaps in studies and to improve the academics of school students by increasing self-paced learning. Self-paced learning is important to cater to the individual differences among learners. Whether YouTube has that potential needs to be explored through this research, as well as the significance of educational videos for school students.

Research Methodology

A mixed Design research method is used that includes both Qualitative and Quantitative Approaches for which the Questionnaire is prepared, and the questions are both open-ended to analyze qualitative and Quantitative Analysis. Interviews are also being conducted with students of various schools to check the effect of YouTube educational videos on their studies. For Qualitative Design, the data is collected through interview schedules; major themes are identified as time spent on YouTube by the students, purpose of study, and time slots for using YouTube.

Tool

Questions are prepared of both types open-ended and closed-ended. Also, the interviews were conducted with school students. Questions prepared related to YouTube as whether students are familiar with the portal or not, how much time they spend on YouTube, whether they are able to get quality education through YouTube, and what is the significant role of these educational videos in improving their academic performance. Google form is used to collect data, and semi-structured interviews are conducted in which data is gathered through school students who use YouTube as a medium of study. Open-ended questions are asked to them, and their personal experience of learning is asked while studying through YouTube as a medium of the platform.

Sample and data collection methods

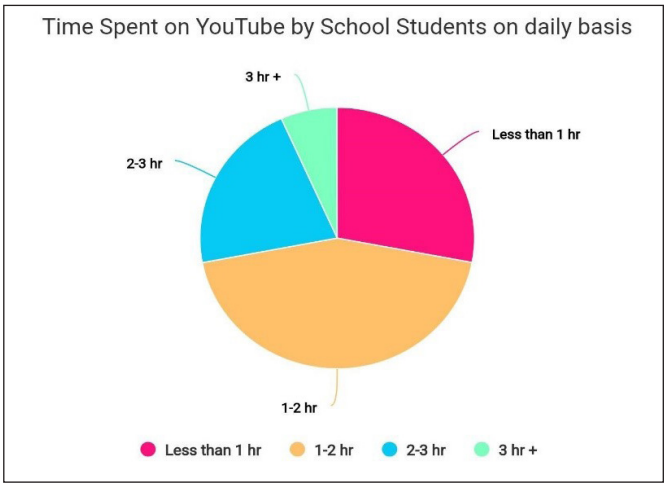
Random sampling technique is used as different school students of different classes are used to collect the data. Data is collected through Google Forms. A questionnaire is prepared to collect the data from school students and Google form is used as a medium to find out the answers. 5-point rating scale, open-ended questions to analyze data qualitatively and also close-ended questions to analyze the opinion of the learners. School students of classes 6th

-12th are used as a sample to conduct this study. Data is presented through pie chart and bar graph based on the utility. Also, theme based data analysis is done through the study.

Data Findings and Interpretations

It has been found that all the students are familiar with the YouTube videos and use YouTube as a platform to study. Total 75 participants participated in the questionnaire through Google form out of which 40 per cent are female that are 30 and 60 per cent are male that are 45. All of them know about YouTube and know about certain YouTube channels which they used to study. This clearly shows they have exposure to YouTube. 88.9 per cent of students have been exposed to Mobile learning, and they share that many times it helps them, and exposure to mobile learning signifies progressiveness in terms of equality and exposure to the studies. Still, 11.1 per cent of students do not have exposure to mobile learning due to many reasons, such as not having access to Mobile phones or not having internet packages, etc., which shows the Digital Divide among the population. 68.5 per cent of students spend time on YouTube daily for study purposes.

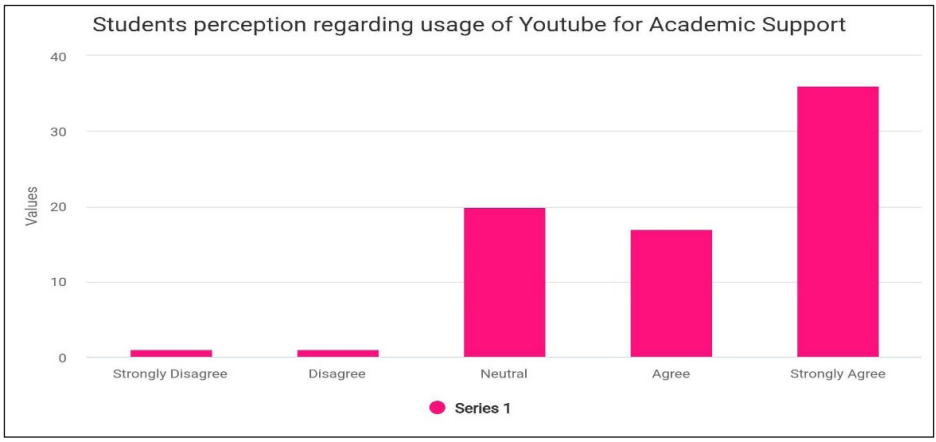
Figure-1: Time Spent on YouTube by School Students on daily basis



Many learners find out that YouTube is a very interesting and engaging platform for them because there are a number of teachers teaching the same concept in different ways, which helps them fill the learning gaps. The topic they are not able to understand properly, they can listen to it again and again. It is found that students spend time on YouTube to study and also to find information related to studies, like to know about admission procedure, certain notification details, etc. 48 per cent of students out of a total of 75 participants prefer recorded lectures instead of live sessions on YouTube which shows that live classes through YouTube are not that much effective and the reason behind that is a lot of advertisements and unnecessary comments discussed during the class. 48 per cent, approximately half of the sample, strongly agree that YouTube educational videos help them fill the learning gaps. These educational videos help them to achieve good scores and enhance their academic process. Most participants use YouTube as a medium to study, and when they are absent or not able to understand the concept

in the classroom, they use YouTube videos. 48 per cent, almost half of the population, prefer recorded lectures only. In interview schedules, the major findings were that students prefer recorded lectures over live lectures because it saves their time, and they will increase the speed and playback again and again until they understand the concept clearly.

Figure-2: Students' Perception Regarding Usage of YouTube for Educational Support



36 out of 75 students that is 48 per cent strongly agree that usage of YouTube for educational purposes helps them in academics. YouTube Educational Videos are very effective as this is the platform that almost every student visits once, and the research is being conducted on the students of schools from both private and government backgrounds. The result is that YouTube is a great medium to study, but there are certain distractions. Many students said that after a few minutes, there would be an advertisement, and because of that advertisement, they lose their concentration level and then move to the shorts or some sort of entertainment which hinders their learning. But at the same time, some students are very enthusiastic and learn from the various channels of YouTube not only for educational, and academic-related topics but also for future trends like universe-related topics, channels, etc. One of the major findings through the data is YouTube Educational Videos using animations which make learning interesting and increase retention power of the learners. The key findings are that some students use YouTube for their studies when there is some doubt or for specific topics and subjects, some use it for checking for NCERT solutions. Purposes may vary but somehow it is clearly found that it is a platform which is used by students widely and impacts the study of the learners and hence help in bridging the learning gaps among learners. NCERT official YouTube channel provides audio as well as audio-video content delivered by experts helps the learners. E- content is created by NCERT in various formats for school education that helps the learners (Jain & Babbar, 2024).

Implications and limitations of the study

YouTube educational Videos are very effective for long-term memory and also for self-paced learning of individuals. NEP 2020 laid emphasis on the usage of technology in studies. As 21st century

learners, the study using technology is the need of the hour. The appropriate skills must be developed among the learners to use the technology effectively and in this the role of parents and teachers comes to guide the students from time to time. Also, YouTube as a platform has the potential to reach remote areas and help the learners to study. The lockdown also has impacts on the school students as they lack the basics. Some students find it difficult to understand, so they use YouTube so they can rewind the videos many times. Many teachers can explain the same concept so a learner can identify the teacher with whom he /she wants to learn depending on the way of teaching. (Lee et.al, 2017) YouTube compares through self-directed learning perspective by making sense of comments on YouTube educational videos. This shows the clear and strong implications of YouTube educational videos and the limitations in the collection of data. More responses can be added or analyzed. Limitations can be time-variant because time is always lacking on both sides for researchers as well as for the samples.

Conclusion

The integration of technology in education is the need of the hour. After lockdown, it is more important to use technology in education to make it interesting for the students as their concentration power affects it. Learners find YouTube an interesting platform to study because of its features and mechanisms of short and pause options, and rewind options and it is the tool they use for self-paced learning again school teaching or formal training cannot replace these platforms but still have a significant impact on the studies of the learners and to make them curious with the new ideas and innovations.

Recommendations by NEP 2020

NEP 2020 laid emphasis on the integration of technology in education. Technological adoption, when applied in an effective way, has the potential to present appreciable results in education. Educational videos have long-term effects, and YouTube plays an important role. Almost all learners say that they know YouTube and they use it; some use it continuously, and some rarely, but nobody says that they don't know about YouTube. This shows the popularity and, hence, the requirement of study in this field. Educational Technology is an emerging field in the era of the technological revolution. NEP 2020 suggests extensive use of technology in the education system as teaching and learning that helps in removing language barriers, increasing access to special children and helping to cater to educational planning and management (NEP, 2020). National Education policy document on bullet point 6.13. recommends appropriate technology allowing children to study at their own pace and integrate YouTube to provide a significant platform to study at their own pace.

Contribution to the field and recommendations for future research

As broadcast and technical Web portals are beginning to merge with social networking Web sites, it is important to consider how new spaces can leverage Web 2.0 technologies to create a sociotechnical participatory culture in which members feel empowered to engage and participate. More detailed research can be done in terms of comparison of various channels or the types of teachers and the reason for the popularity of certain videos or the learner choice, etc. More detailed research can be done that includes

more geographical areas because, according to areas, the needs and the findings differ. The detailed analysis of the quality of educational videos and their authenticity can be explored in future as it is very important to know what kind of content is delivered and what its significant effects on learners are. Every classroom must be equipped with the latest-enabled technology (NEP, 2020).

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Research Article

A Study on Techno Pedagogical Skills of College Teachers in West Bengal

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Abstract

The use of Technological Pedagogical Skills (TPS) can make quality education available and inexpensive to everyone. The use of TPS can make teaching and learning enjoyable because it alters how teachers and learners engage with one another. When teachers acquire technological pedagogical skills, they may try to apply them frequently in their instruction to improve the teaching-learning process. This study attempts to find out and compare the techno-pedagogical skills of college teachers with reference to gender, locality, stream, caste, and types of jobs. The descriptive survey method was used. One hundred forty college teachers were selected through simple random sampling techniques as samples from the Bankura district of West Bengal, India. Techno Pedagogical Skills scale consisting of 40 items based on four aspects: Technological Skills, Pedagogical Skills, Skills related to Subject or Content and Planning and Decision-making Skills was used in the present study as a tool for data collection. The data of the study were analysed by using the Statistical Package for Social Sciences (SPSS) 21 software. It was also found that there is no significant difference in the TPSs of college teachers with respect to their gender, locality, and caste. It is revealed that the TPSs of college teachers are at an average level. The study also discovered that there are statistically significant differences in the TPSs among the college teachers with respect to the type of jobs and stream. The study has implications for college principals, university administrators, and policymakers in providing training on TPSs to college teachers so that their capacity can be built.

Keywords: Technology, Pedagogy, Skill, Techno Pedagogical Skill, College Teachers

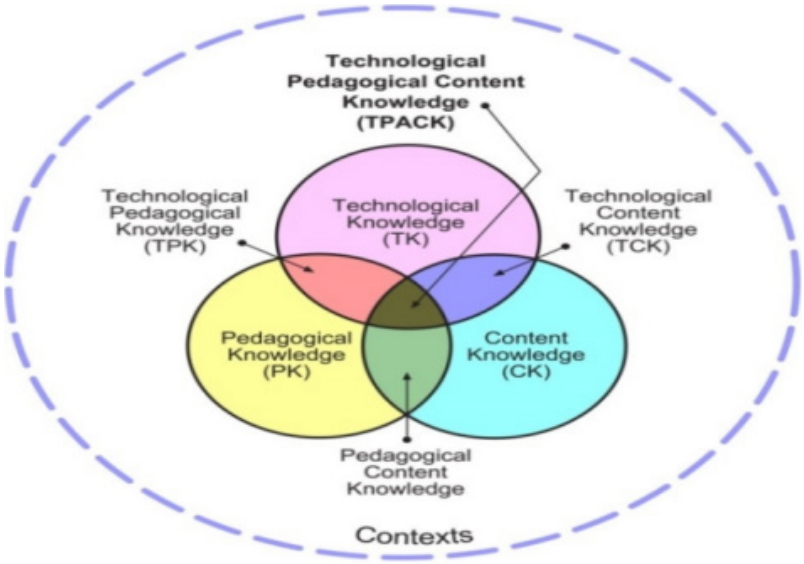
Introduction

Rabindranath Tagore, the great poet and educationist, rightly said, "Real education is that which does not merely give us information but makes our life in harmony with all existence". The literate citizen is increasingly expected to access and alter information via computer technology in the 21st century. It's critical to know how to manage electronic data from a growing number of sources and in a variety of forms (Gloria & Benjamin, 2014). As a teacher, one should grasp the value of technology because it allows students to understand the information more readily (Guru & Beura, 2019). The use of technology in education has been shown to be significant in terms of adjusting to period requirements, saving time, and enhancing efficiency (Cam & Koc, 2019).

Teachers who gain techno-pedagogical abilities may attempt to apply them frequently in their teaching, resulting in a simple and effective learning process (Anand, 2019). Technology has long been acknowledged as a powerful enabler with enormous potential for improving educational processes (Atkinson & Castro, 2008). The integration of technology into the educational process will result in appropriate modifications and advancements in both the educational and technological landscapes (Bala & Tao, 2018). The majority of teachers use the term "techno-pedagogy" to refer to online lectures. A platform comprising course management systems, asynchronous presentations, videoconferencing, and online evaluation tools is used by several of them (Courts & Tucker, 2012).The student can tailor their education thanks to the flexibility and choice brought about by technology (Hart, 2016). The content, pedagogy, and technology are the three pillars of techno pedagogy. Pedagogy is a term that refers to a collection of teaching and learning techniques, tactics, procedures, and methodologies (Ali, 2018). The ability to use ICT in a pedagogical environment is termed techno-pedagogical skills. Only a few researchers have looked into the methods utilized to help instructors build their techno-pedagogical skills (Grenon et al., 2019). Developing techno-pedagogical skills will make teaching and learning enjoyable since it will relieve pressure on teachers and allow students to engage more deeply in the process of learning (Lyonga et al., 2021). The use of techno pedagogy encourages teachers to use technology to communicate knowledge, and the learner maintains an on-going interest in learning new things (Prasanth & Rajan, 2022). Through the use of ICT by teachers, techno-pedagogical skills encourage students' further development, achievement of learning outcomes, and maintenance of the context of building classroom-based resources. As a result, the method of techno-pedagogy was a vital component of teacher education (Beaudin & Hadden, 2004).

Technological Pedagogical and Content Knowledge (TPACK) has had a significant impact on the field of educational technology research (Cox & Graham, 2009).In the framework of technological pedagogical and content knowledge (Figure 1), the paradigm known as technological pedagogical content knowledge (TPACK) describes how teachers can use technology more successfully. In this context, the TPACK competencies of teachers are crucial (Yildiz & Baltaci, 2017). According to Koehler and Mishra (2009) "TPK requires a forward-looking, creative, and open-minded seeking of technology use, not for its own sake but for the sake of advancing student learning and understanding" (p. 66). As a result, teachers anticipate that technology will be employed in the classroom teaching-learning process to assist them in studying, developing important ICT skills, and mastering the technology fluency required in their individual subject domain (Keshwan, 2015). So, technological pedagogical competency is an important capacity of teachers that must be cultivated in order to convey knowledge to students in a meaningful way (Ali, 2018).

Figure-1: Technological Pedagogical Content Knowledge



Source: TPACK (Koehler & Mishra, 2009)

Need of the Study

The National Education Policy 2020 has emphasized including ICT in all levels of education. Technology must be used as teaching, learning and assessment aid for all levels of education. It has the potential to transform the nature, process and product of education across levels of education and subjects. Hence, it is an important area of educational research which has been focused by both national and international researchers. Some of the important research findings are discussed here.

Jain and Singh (2023) focused on the effect of generative AI on techno-pedagogical skills and the effect of generative AI on the happiness of prospective teachers. A mixed-methods approach was employed to investigate the effect of using generative AI tools in teaching. There were thirty prospective teachers in the study's sample. The study revealed the positive effect of employing generative AI-based applications on prospective teachers' happiness and techno-pedagogical skills. This study demonstrates that generative AI technologies are able to support prospective teachers' techno-pedagogical skills and happiness. Kulaksiz and Karaca (2022) discovered that TPACK is context-oriented in addition to being a set of stand-alone knowledge and skills. Setua (2022) revealed that there is an averagely positive relationship between effective online teaching and technological pedagogical skills. They also found that there is a significant difference between the high level and low level of techno-pedagogical skills of secondary school teachers with their effective online teaching. Yusuf et al. (2021) reported the gender differences in student teachers' perceptions of their Technological Knowledge (TK) and Technological Content Knowledge (TCK) favouring male respondents. Melo (2020) investigated Pedagogical Content Knowledge (PCK) or becoming a physics teacher in a Colombian secondary school. The study found that knowledge about the curriculum and teaching practices evolved following

the intervention program. However, information regarding evaluation and learners did not. Beri and Sharma (2019) concluded that the technological pedagogical competency of teacher educators in private colleges is higher than that of teacher educators in government/government-aided colleges. They also discovered that teacher-educators with a science background have significantly higher Techno-Pedagogical Competencies than those with an arts background. Bala and Tao (2018) revealed that senior secondary school teachers in the Phagwara district have excellent techno-pedagogical competence and a low level of fear about using instructional aids in the classroom. Yildiz and Baltaci (2017) revealed that teachers had made significant improvements in the design, implementation, and problem-solving internee of TPACK competencies. Ozdemir (2016) discovered that pre-service teachers who took technology and material development courses improved their TPACK. Thakur (2015) mentioned in his paper how to integrate technology and pedagogy so that both teachers and students are aware of how technology can be used to shape educational demands.

The above discussion indicated that many types of research are carried out on teaching competence, the use of technology in teaching, as well as on techno-pedagogical content knowledge among school teachers at the secondary level. Few studies have also been carried out on the Techno-Pedagogical Skills of B.Ed. students. However, no researchers reported that it was carried out on the Techno Pedagogical Skills (TPS) of college teachers in West Bengal. Hence, this gap led to the study of techno-pedagogical skills among college teachers in a particular region of West Bengal.

Objectives

1. To find out the Techno Pedagogical Skills (TPS) of college teachers.
2. To find out the difference in TPS of college teachers with respect to gender (Male & Female) and Locality (Rural & Urban).
3. To find out the difference in TPS of college teachers with respect to the type of jobs (Permanent, State Aided College Teacher-I, State Aided College Teacher-II and Visiting Faculty), Caste (General, SC, ST and OBC) and Stream (Arts, Science and Commerce).

Hypotheses

1. The college teachers will have low Techno Pedagogical Skills.
2. There is no significant difference in the TPS of college teachers with respect to their gender (Male & Female) and locality (Rural and Urban).
3. There is no significant difference in TPS of college teachers with respect to their type of jobs (Permanent, State Aided College Teacher-I, State Aided College Teacher-II and Visiting Faculty), caste (General, SC, ST and OBC) and stream (Arts, Science, and Commerce).

Methodology

The survey method was used to examine the current state of TPS of college teachers. The study was confined to the Bankura district of West Bengal, India. Only state-aided general college teachers (Govt. of West Bengal) were considered in the present study. The male and female, rural and urban, arts, science, and commerce streams, different castes, permanent, visiting, and state-aided college teachers were

involved in this study. A total of 140 college teachers from the Bankura district were taken as the representative sample of the whole population (Table 1). A simple random sampling technique was adopted to select college teachers from the Bankura district of West Bengal. The details of the sample are given in table-1.

Table-1: Details of Sample

Variable		N	Total
Gender	Male	104	140
	Female	36	
Locality	Rural	95	140
	Urban	45	
Stream	Arts	92	140
	Science	44	
	Commerce	4	
Caste	General	98	140
	SC	11	
	ST	2	
	OBC	29	
Type of Jobs	Permanent	76	140
	SACT-I	17	
	SACT-II	44	
	Visiting Faculty	3	

The Techno Pedagogical Skill Scale was constructed by the investigators to know the techno-pedagogical skills of college teachers. The investigators built the original tool using four dimensions and forty statements. The dimensions were Technological Skills (10 Items), Pedagogical Skills (10 Items), Skills related to Subject or Content (10 Items) and Planning and decision-making Skills (10 Items). Every item was in statements with five choices such as Strongly Agree, Agree, Neutral, Disagree and Strongly Disagree. All statements on the scale were positive in measuring techno pedagogical skills. In each dimension, there were groups of statements. Each element explained certain behaviours. In the scoring procedure, the score of 5 for Strongly Agree, 4 for Agree, 3 for Neutral, 2 for Disagree and 1 for Strongly Disagree. The test-retest reliability of the scale was found to be 0.87 with a time gap of 10 days. Content validity has been established for the scale by referring it to experts in the field. The college teachers submitted their responses both via Google Forms

and offline once they had finished their responses according to the instructions. Non-parametric tests such as Mann-Whitney U and Kruskal-Wallis tests were used to analyse the collected data and verify the hypotheses.

Result and Discussion

The collected data were analysed as per the objectives and hypotheses of the study by using non-parametric measures, which are presented in the following paragraphs.

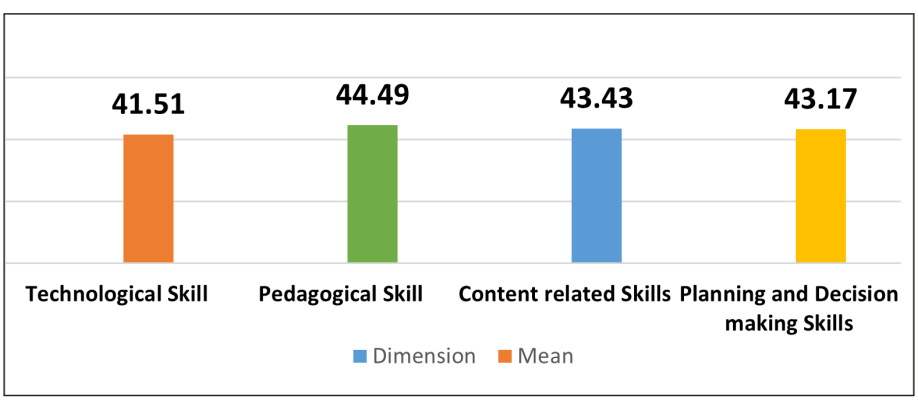
Level of Techno-Pedagogical Skills of College Teachers

Table-2: The Level of Techno Pedagogical Skills of College Teachers

Percentile Range	Raw Scores Range	No. of Sample	% of Sample	Level of Techno-Pedagogical Skills
Above P75	Above 185	33	23.57	High
P25 to P75	162 – 185	74	52.86	Moderate
Below P25	Below 162	33	23.57	Low

From the Table 2, it is found that 33 (23.57 per cent) college teachers had low levels of Techno Pedagogical Skills, 74 (52.86 per cent) college teachers had moderate levels of Techno Pedagogical Skills, and 33 (23.57 per cent) college teachers had high levels of Techno Pedagogical Skills. The trend of the level of Techno Pedagogical Skills revealed in the study insisted that the researchers conclude the result to be neither high nor low but satisfactory or moderate.

Figure-2: Dimension-wise Mean of Techno Pedagogical Skills Score of College Teachers



From Figure 2, it is also explored that the pedagogical skills (Dimension-2) of College Teachers are comparatively higher than other skills or dimensions and technological skills of college teachers are relatively very low than other skills.

Comparison of TPS of College Teachers with Reference to Sex and Locality

Table-3: Mann-Whitney U Test

Variables		N	Mean	Mann Whitney U Value	Z value	p	Remarks
Gender	Male College Teachers	104	71.87	1730.000	-.677	0.498	Not Significant
	Female College Teachers	36	66.56				
Locality	Rural College Teachers	95	69.36	2029.500	-.482	0.630	Not Significant
	Urban College Teachers	45	72.90				

The above test statistics (Table 3) show that the Mann-Whitney U value =1730.000, Z value = -.677, p= 0.498 (p> 0.05). Hence, it is not significant, and H02 (Male & Female) is accepted. Therefore, it can be said that there is no significant difference between Male and Female College teachers in their scores in Techno Pedagogical Skills. It was also found that the mean Techno Pedagogical Skills score of male college teachers is greater than that of female college teachers.

The above test statistics (Table 3) show that the Mann-Whitney U value=2029.500, Z value=-.482, p=0.630 (p>0.05). Hence, it is not significant, and H_{02} (Rural and Urban) is retained. Therefore, it can be said that there is no significant difference between rural and urban college teachers in terms of their scores in techno-pedagogical skills. It is also found that the mean Techno Pedagogical Skills score of urban College Teachers is greater than rural College Teachers.

Comparison of TPS of College Teachers with Reference to Type of Jobs

Table-4: Results of Kruskal-Wallis Test for Type of Jobs

Groups	N	Mean Rank	Chi-square	df	p	Remarks
Permanent	76	82.47	15.814	3	.001	Significant
SACT-1	17	63.35				
SACT-II	44	52.51				
Visiting Faculty	3	71.67				

The above test statistics (Table 4) show that the Chi-Square value =15.814, df =3, p=.001 (p<0.05). Hence, it is significant and H03 (Permanent, SACT-I, SACT-II, Visiting Faculty) is rejected. Therefore, it can be said that there are significant differences in TPS among Permanent, SACT-I, SACT-II and Visiting College

teachers. It was also found that the mean Techno Pedagogical Skills score of permanent teachers is higher than others.

Comparison of TPS of College Teachers with Reference to Caste

Table-5: Kruskal-Wallis Test for Caste

Groups	N	Mean Rank	Chi-square	df	p	Remarks
General	98	71.22	7.451	3	.059	Not Significant
SC	11	88.14				
ST	2	6.75				
OBC	29	65.78				

The above test statistics (Table 5) show that the Chi-Square value is 7.451, df =3, p= .059 (p>0.05). Hence, it is not significant that H03 (General, SC, ST and OBC) is accepted. Therefore, it can be said that there are no significant differences among General, SC, ST, and OBC College Teachers in their scores in Techno Pedagogical Skills. That is to say that the Techno Pedagogical Skills of Schedule Caste (SC) college teachers are comparatively higher than those of another caste.

Comparison of TPS of College Teachers with Reference to Stream

Table-6: Results of Kruskal-Wallis Test for Stream

Groups	N	Mean Rank	Chi-square	df	p	Remarks
Arts	92	62.41	11.539	2	0.003	Significant
Science	44	87.64				
Commerce	4	68.13				

The above test statistics (Table 6) show that the Chi-Square value is 11.539, df =2, p= .003 (p<0.05). Hence, it is significant. The H_{03} (Arts, Science, and Commerce) is rejected. Therefore, it can be said that there are significant differences among Arts, Science, and Commerce College Teachers in their scores in Techno Pedagogical Skills. That is to say that the Techno Pedagogical Skills of science college teachers are relatively higher than arts and commerce teachers.

Discussion of Result

The study found that the Techno Pedagogical Skills of college teachers are moderate in level. This is due to the fact that most teachers know the content and pedagogy very well but lack the inclusion of technology. Few teachers plan and decide their instruction effectively. The present finding corroborates the findings of the study conducted by Sathiyaraj & Rajasekar (2013), Sekhar (2016), Jeyaraj & Ramnath (2018), and Kumar (2018), contradicts the findings of Thakur (2015), Bhuyan and Tripathy (2020).

It is found that the Techno-Pedagogical Skills of male college teachers are comparatively higher than those of female college teachers. This is due

to the fact that male college teachers are smarter in utilizing the content through the integration of technology in the classroom situation than female college teachers. It is also found that male teachers are more interested in their teaching through technology, while female college teachers are not comfortable using technology in their teaching. The present study also supported the earlier finding of Anand (2019), who concluded that the techno-pedagogical skill of male faculty members is better than that of female faculty members.

The study revealed that urban college teachers have comparatively higher techno-pedagogical skills than rural college teachers. It is also evident that teachers at urban colleges are more interested in employing technology to enhance their instruction than teachers at rural colleges. At the time of data collection, it is seen that adequate technological facilities are available in urban colleges than the rural colleges. The present study also supported the earlier finding of Parkash & Hooda (2018), who concluded that the techno-pedagogical competency of urban government school teachers is better than that of rural government higher secondary school teachers.

It was found that permanent college teachers are comparatively more skilled in techno-pedagogy than their counterparts. For this reason, permanent teachers use technology in the classroom more intelligently than other college teachers, which makes them better at utilizing the course material. Additionally, it has been discovered that permanent teachers are more enthusiastic about employing technology in their instruction than other college teachers.

The current study revealed that the college teachers belonging to the SC community were having higher Techno-Pedagogical Skills than their counterparts. It is the result of the SC college teachers' superior knowledge of how to use the subject by incorporating technology in the classroom environment as compared to other category teachers. Additionally, it has been discovered that SC college teachers are more interested in adopting technology to enhance their instruction than other category teachers in the colleges.

The present study exposed that science college teachers have higher techno-pedagogical skills than their counterparts. The reason for this is that science college teachers are more adept than other college teachers at utilising the subject by integrating technology in the classroom. It's because science college teachers are more adept than other college teachers at utilizing the subject matter in a classroom setting by integrating technology. The findings of the study are corroborated by the studies of Sathya & Venkateswaran (2017), Yildiz (2017) and Kumar (2018).

Educational Implications

Techno-pedagogical skills are very essential to make teaching learning effective and qualitative at all levels of education. The study revealed that the college teachers in West Bengal have moderate/average Techno Pedagogical Skills. As this study was a humble attempt to know the level of techno-pedagogical skills of college teachers, it will assist policymakers in addressing the challenges of developing the much-said among college teachers. Along with that, the improvement of the skills of teachers will improve the overall quality of education. The government could take the initiative to improve college teachers' TPS skills and could initiate adequate online/ or blended courses for their improvement. Govt. can start various initiatives such as workshops, seminars,

ICT-based orientation programmes and skill-building programmes related to TPS to enhance college teachers' skills in technology and pedagogy. According to the findings of the study female, rural, ST, arts, and SACT-II college teachers need special training to equip them with new inventions to improve. It was also revealed that a fundamental understanding of integrating technology and content with pedagogy in education is necessary for college teachers. It will assist the governing bodies in providing the essential infrastructure, such as sufficient classrooms, computers, internet access, and communication tools for college teachers, to ensure efficient operation.

Conclusion

The passage of time causes everything in our nature to change. This transition is a continuous process where everything changes automatically; it cannot be detected by drawing sectional lines. The transition from the traditional Gurukul system to a formal schooling system in the sphere of education has an impact on the teaching process, how students connect with one another, and how they participate in the teaching-learning process. The old lecture style and teacher-centred education system are replaced by a student-centred approach in which interaction is the key to learning. A classroom without technology nowadays is inconceivable since students of this generation are "digital natives." A teacher becomes a techno pedagogue when they combine technology with pedagogy. When transmitting lessons to students through a voyage of a virtual world, teachers should be fully aware of the usage of emerging technology. Every educational professional should be able to effectively integrate subject-specific content, pedagogy, and technology into their classroom interactions. A significant barrier to integrating these three key components is discovered to be teachers' lack of awareness of technological pedagogical abilities. It is possible to conclude that technological-pedagogical skills is an important capacity of teachers that must be cultivated in order to convey knowledge to students in a meaningful way.

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Research Article

Augmented Podcasts: A Low Bandwidth Solution for Effective Learning

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Abstract

The evolution of video has significantly transformed the ways in which educational content is delivered and consumed. Post the pandemic, the digital divide existing in the Indian educational system is more evident, which creates a requirement of low bandwidth educational technologies, without compromising learning effectiveness. This study proposes a new medium: Augmented podcasts (MP3 file + PDF file of the screenshots used in the lecture), an audio narration synchronised with slides, as a more bandwidth-friendly alternative to traditional video lectures. We compare the data consumption and effectiveness of augmented podcasts as an educational tool in comparison to traditional video lectures. The comparison is done based on three main levels of difficulty (low-medium-high) in the assessments of these lectures. The study employs a quantitative approach with an experimental design. Participants from urban areas of Mumbai were initially selected using purposive sampling. These participants were then randomly assigned to either of the two groups: the augmented podcast or video lecture group. Descriptive and inferential statistics, including Mann-Whitney U tests, were used for data analysis

In addition to a significant reduction in the data payload compared to video lectures, the findings reveal that augmented podcasts are equally as effective in promoting learning, with no significant differences observed in their test scores in low and medium level learning. However, findings reveal a significant difference in high-level learning. The research also highlights consistent engagement levels with augmented podcasts compared to video lectures, offering key insights for curriculum designers and educators to optimize instructional materials.

Keywords: Augmented podcasts, video lectures, digital divide, low bandwidth, scores, instructional materials

Introduction

The dynamic world of digital education is characterised by the pursuit of effective and accessible instructional methods and resources is a continuous challenge. The proliferation of online education is undeniable. MOOCs and online education with video content as a major component are an established format. However, disparities in internet connectivity persist as one of the major impediments for online education.

At the same time, technology providers are developing user-friendly, crossover technologies that allow users to access information anytime, anywhere on

multiple devices in different forms and formats (Evans, 2008). With exponential technological advancement, where media and technologies are becoming easier to mix, merge and evolve, it has added to the innovative ways to utilise them in education (Carson et al., 2021). With education becoming learner-centric, more autonomy lies with the learners leading to rise in asynchronous learning.

One of the popular asynchronous media amongst the millennial generation is Podcasts. The presence of multiple podcasting platforms, including those by tech giants, is a testimony in itself to the popularity. While the audio format of media has a long history in terms of radio, its resurgence in the form of Podcasts provides educators with a motive to experiment with its usage in learning as an easy-to-access media for learning (Besser et al., 2021). There are several types of podcasts which can be used in education (Forbes and Khoo, 2015). Nevertheless, recent research has also brought forth certain disadvantages, such as lack of visual cues, distractions, lack of interaction, and limited note taking, amongst others.

Despite these disadvantages, there have been multiple researches on various aspects of using podcasts in education (Gunderson and Cumming., 2022). Recognizing the need for a more accessible medium, this research investigates the potential payload reduction when transitioning from video lectures to a hybrid option of audio augmented with text. This study looks at augmented podcasts as an educational media as a solution for reducing the digital divide by addressing bandwidth without compromising learner engagement. By delving into the preferences and experiences of students, this study aims to discern the impact of this hybrid format on learning outcomes, engagement, and satisfaction. Through this exploration, the goal of this research is to contribute valuable insights that can inform educational practices and enhance the inclusivity of digital learning platforms in diverse settings.

Literature Review

The evolution of Web 2.0 has democratised content creation, broadening access and empowering contributors with greater control over content consumption. Numerous studies have examined aspects such as engagement, student perception, and motivation for using educational podcasts, along with the overall impact of media usage. Research across various fields, from the humanities to medical education, provides insights into the use, preferences, and impacts of different media in education. In all these media formats, the use of videos in higher education and, in particular, distance learning courses has increased significantly in recent years (Harrison, 2019). Post-pandemic, video-based solutions have quickly become the most sought-after alternative to in-person instruction (Wang et al., 2021). On the other hand, the increasing availability of podcasts before and during the peri-pandemic period reflects learners' growing preference for this medium as a valuable option for acquiring knowledge (Okonski et al., 2022). This leads to the subsequent inquiry regarding the methods for assessing the effectiveness of such educational interventions.

Typically, the effectiveness of educational interventions is measured using achievement scores. In education, experimental and quantitative methods, including surveys and test scores, are commonly used to assess

behaviour change and intervention effects. Another crucial area is the data payload, which influences policymakers and content creators to make informed decisions, ensuring accessibility and inclusivity.

With this background, the literature review of this study comprises three distinct sections. The first section reviews studies on the effectiveness of podcasts as educational tools. The second section examines literature comparing the effectiveness of audio media versus video lectures as educational tools. The final section sets the stage for the current study by presenting consumption and usage metrics and trends.

Effectiveness of Podcasts as an Educational Tool

Podcasts have been a popular informal education medium in Medical Education (Berk et al., 2020). Though there have been disadvantages like distractions, medical residents informed that podcasts gave them a broader sense of core content and personalised learning, as well as fostering their connections to communities- local and national (Riddell et al., 2020). Research studies have also put forth how podcasts were leveraged as a tool for continuing medical education during the pandemic (Tarchichi and Szymusiak, 2020).

The study of using podcasts as an instructional tool for a Leadership Education Course showed several benefits and preferences of students, especially in a post-pandemic world (McCarron and Yamanaka, 2022). Podcasts have been shown to provide opportunities for reflective inquiry, aid communities of practice and help negotiate theoretical and practical knowledge (Turner et al., 2021). Systematic Review of 17 studies podcasts aligns well with the principles of Universal Design for Learning (UDL) and serves as a unique way of engagement despite its limited impact on academic achievement (Gunderson and Cumming, 2022). Research has shown that listening to podcasts closely helps in identifying logical and coherent thinking, thereby improving students' analytical abilities and writing skills (Vandenberg, 2018). Following a socio-cultural approach, podcasts have shown to provide for establishing student agency in learning and collaboration (Carson et al., 2021).

Another study highlights the role of podcasts in education planning and asserts that podcasts can enhance active learning in Blended learning environments (Moore, 2022). An empirical study on best practices of using podcasts as "readings" revealed that students who read the podcast transcripts were able to score more than the students who heard only podcasts (Oslawski-Lopez and Kordsmeier, 2021).

Podcast vs Educational Videos as Learning Resources

Podcasts, though having only audio content, have been found to be effective in improving achievement scores as well as enhancing critical thinking, analytical thinking, problem-solving and deeper reflections, along with an increase in their respective scores in the domain of Business and Information System (Jager et al., 2023). A similar study (Yasmiatun, 2023) reported increased critical thinking skills along with better engagement in an EFL class. Musa (2021) found that both basic podcasts and vodcasts increased student achievement scores in the technical subject of woodwork as compared to the traditional methods of teaching-learning. A phenomenological study

by Nurani et al. (2023) showed that 76.92 per cent of students understood learning materials with podcast media using the Spotify platform as a learning resource. Ahmad (2023) found that an Information Technology course that used podcasts as micro-learning tools showed higher achievement, especially for female students.

Song and Marchionini (2007) put forth the term 'surrogates' (condensed representation of entire digital media) and studied the effectiveness and impact of three surrogates- audio, visual, text-based storyboard, individual and in combinations (e.g. storyboard + audio) which sometimes were not in sync. This study revealed that participants could combine these surrogates for learning even if they were not synced. The study also concluded that combined surrogates were preferred, effective, and did not compromise on learning efficiency as measured by

post-experiment tasks and questionnaires. It also brings up the question of the need to synchronise various multimedia channels. In yet another multimethod study (Ilin,2021) on the effectiveness of three media types (audio, video and e-text) in blended learning reports that user preference is the determinant in usage and hence in the resultant effectiveness of the particular media. The same study disclosed that for 13-year-olds, it was usefulness and enjoyment that dictated the preference.

The reviewed literature indicates the scope of studying podcasts as an educational tool in the learning environments that are becoming increasingly digital every passing day. It can be safely concluded that when it comes to media usage, the 'no -no-size-fits-all' paradigm becomes of utmost importance.

Podcasts as a new media: The digital footprints

India has a history of using audio mediums in the form of radio for freedom struggle and social reform. This may be considered as an ease and conditioning of people in India towards audio medium. In the modern days, this has to be looked at in terms of data usage/consumption of audio medium with a specific reference to podcasts for this study.

The digital population of India in 2023 is reported to be 6.92 million and smartphone users around 1 billion (Basuroy, 2023; Sun, 2023). Data consumption of video streaming and audio streaming has been reported and spoken about on various technical platforms. It has been reported that video streaming data consumption is between 100 MB to 7 GB per hour and the consumption for audio/podcast streaming lies between 43-144 MB per hour. According to a survey conducted in September 2023, 27 per cent of urban Indians listen to podcasts at least once daily and another 25 per cent listen to podcasts two-three times per week. Only 10 per cent of urban Indians reported never listening to podcasts. It is also interesting to note that the CAGR report predicts market penetration of podcasts in India to be around 43 per cent in 2024 after showing steady growth since 2019.

The use of podcasts as an educational tool in India and, thereby, its study is still in its infant stage. There have been studies that revealed its non-usage in Arts and Science Colleges and another one studying the motivation of Indian podcasters in general.

The Study

This quantitative study is part of a

larger mixed method research project that studies the efficacy of augmented podcasts as educational tools. Drawing from the reviewed literature, the present study focuses on studying the student achievement and engagement through the test scores with augmented podcasts vis-a-vis videos amongst students enrolled in an higher education institution in the urban area of Mumbai.

Operational Definitions

This research uses terms which are defined as follows in the purview of the given study.

1. Augmented Podcasts: A content format with two distinct files, MP3 and PDF, accessible on the same page of the Learning Management System (LMS). The user begins to play the MP3 file for audio content and instructions. Once the audio starts, the user opens the PDF, which contains the corresponding visuals. The instructions to navigate the PDF are provided in the MP3 file via a bell sound. Users have the flexibility to move back and forth in both the files independently.
2. Payload: The file size of the augmented podcast and the video expressed in KB/MB/GB.
3. Test Scores: Score obtained by students in the quiz on a particular topic covered in the video or augmented podcast during the experiment.
4. Effectiveness of Interventions: The difference in the test scores of two groups which were given two distinct interventions.

Research Questions

Using podcasts in a large, diverse and developing country of India cannot happen without considering technical feasibility despite being one of the world leaders in the use of Educational Technology. Considering accessibility and effectiveness as the backbone, this study is guided by the following research questions:

RQ1: How much is the payload reduction when a video lecture is converted into a hybrid option of using augmented podcasts?

RQ2: To what extent does the media (Video or Podcast) affect student test scores across different levels of question complexity/difficulty?

Hypothesis

The study puts forth a hypotheses guided by Research Question 2 by three levels of assessment questions:

1. H0: There is no significant difference in the test scores between learners who use augmented podcasts and those who use videos for low-difficulty tests.
2. H0: There is no significant difference in the test scores between learners who use augmented podcasts and those who use videos for medium-difficulty tests.
3. H0: There is no significant difference in the test scores between learners who use augmented podcasts and those who use videos for high-difficulty tests.

Methodology

1. Learning context

A broad and relevant topic was chosen for the experiment, in

order to get larger participation and generate comprehensive data. The SWAYAM course titled: 'Macroeconomics' was selected since it was appropriate to the curriculum of Commercial Banks and Banking System (Commerce). The course covers fundamental as well as advanced topics related to macroeconomics with a focus on application in the banking sector. The course is well structured with comprehensive content making it an ideal choice for this experiment.

To identify the most relevant content for the experiment, a review process was undertaken. The entire course was analysed focusing on the content of the video lectures that matched the objectives of the experiment as well as were relevant to the curriculum of Commercial Banks and Banking Systems. Out of all the available lectures, eight were deemed most suitable for the study on the basis of content, clarity and alignment with experiment goals.

2. Augmented Podcast: A distinct pedagogical innovation:

The key innovation in this study lies in the development of Augmented Podcasts (APs), a structured content format designed to enhance both pedagogical effectiveness and accessibility. Unlike conventional audio-based resources, an AP consists of two separate but synchronized files—an MP3 (audio) and a PDF (visuals/text)—made available on the same page within the Learning Management System (LMS). The learning experience begins when users play the MP3 file, which delivers spoken content along with navigation cues. Simultaneously, learners open the PDF, which contains corresponding visuals, diagrams, or textual highlights. A deliberate bell sound cue embedded in the audio guides learners through the content, signalling when to shift their focus within the PDF. This dual-format approach allows for independent navigation of both files, offering greater learner autonomy and flexibility compared to traditional linear video or audio formats.

The pedagogical intent behind Augmented Podcasts extends beyond simple file separation. Unlike direct audio extractions from video lectures, which often lack coherence when consumed independently, APs are carefully curated and edited to align with their medium. The integration of intentional auditory cues ensures a structured, engaging, and effective learning experience. Moreover, this format reduces file size constraints while maintaining rich, multimodal interaction—making it particularly valuable in bandwidth-limited environments. This innovation was conceptualized with the goal of maximizing accessibility, learner control, and cognitive engagement without the drawbacks associated with passive video consumption.

3. Preparation of Augmented Podcasts

Audio was extracted from the course videos, and saved as MP3 files. Additionally, chronological screenshots were saved from the video. These screenshot images were combined to make a single PDF file. The combination of this modified MP3 (with the marker sounds) and the PDF containing screenshots together form 'Augmented Podcasts'.

Figure-1: Screenshot of Augmented Podcast (MP3 and PDF combination) on the same page of Bookroll LMS

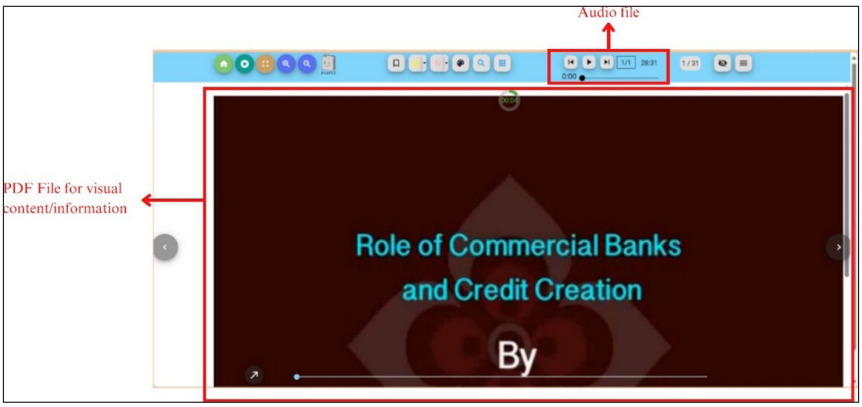

Figure 1 shows an example of Augmented Podcasts. Audio and visuals are operable separately on the same page of Bookroll LMS.

4. Functional Perspective on Payload and Media Comparison:

The comparison of payload (i.e., file size and bandwidth requirements) in this study is not intended as a direct quality comparison between videos and Augmented Podcasts (APs). Instead, it serves a functional purpose, examining whether a combined audio + text format—where both components can be accessed independently—can achieve comparable educational outcomes to video-based learning while significantly reducing bandwidth consumption.

Given the inherently larger file sizes of videos, which incorporate both visual and auditory elements, audio-based and text-based media provide a low-bandwidth alternative, particularly relevant in settings where internet accessibility and data costs are constraints. From a pedagogical standpoint, this study investigates whether the perceived necessity of video-based learning can be mitigated through well-designed Augmented Podcasts. Rather than positioning videos and APs as equivalent substitutes, the study explores their situational advantages—videos excel in visually intensive topics, while for theoretical or concept-heavy content, APs (a structured package of audio and text files) may provide an equally effective, yet more bandwidth-efficient, alternative.

This approach highlights the practical implications of APs in digital education, offering a scalable, adaptable learning format without compromising accessibility or pedagogical intent.

5. The Experimental Setup

This section will delve into three aspects of this study. (a) Online learningtoolsusedfortheexperiment, (b) Participant profile and (c) Research design and data collection.

Online Learning Tools

The augmented podcasts and the video were accessed by both the experimental group (AP) and the control group (AV) via two separate online learning tools. LA-ReflecT (for control group) and Bookroll (for experimental group).

- LA-ReflecT: It is a platform that lets teachers create engaging microlearning activities. Teachers

can design these activities using the authoring tool, and learners can access them through the viewer. LA-ReflecT seamlessly integrates with any LMS that supports the LTI protocol, providing a smooth learning experience for both teachers and students (Majumdar et al., 2023).

Figure-2: The Moodle LMS used to conduct the study

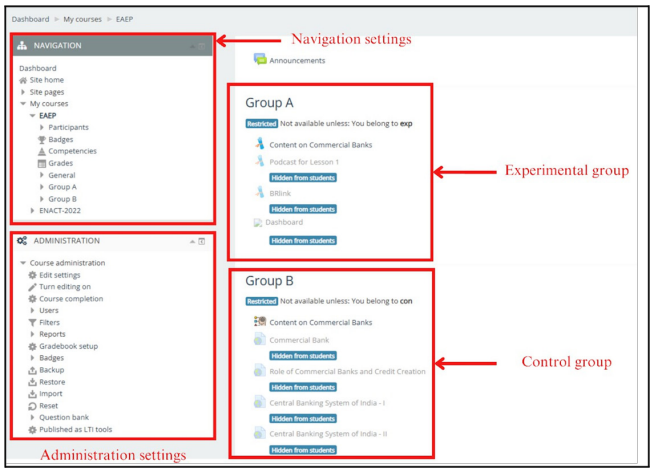

Figure 2 shows the Moodle LMS used for this study.

Two groups were created. Group A - experimental group and Group B - control group. Participants from each group can access the content of their respective group only. The figure also shows the navigation settings and administrative settings. The navigation settings help the instructor to navigate across the courses and let them access information such as badges, completion, grades, divisions. The administration setting allows the instructor to perform administrative-level tasks such as course editing, import/export, generating reports, etc.

- BookRoll: Developed by Kyoto University, is an online e-book system that allows students to view digital materials used in lectures (Ogata, Majumdar & Flanagan, 2023). To make augmented podcasts easily operable Bookroll was chosen as it allows learners to see audio and pdf in a single screen. Both these platforms could be accessed using mobile phones as well as laptops/ desktops.

Figure-3: Lecture materials shared on of Bookroll platform

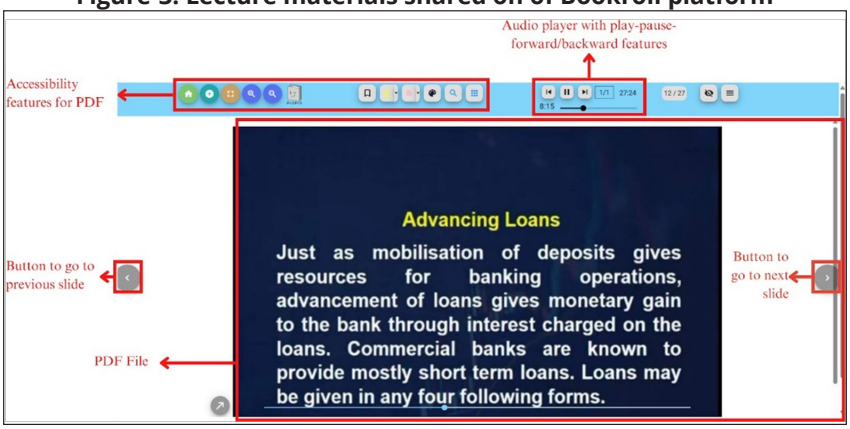
Audio player with play-pause-forward/backward features
Accessibility features for PDF
Button to go to previous slide
Button to go to next slide
PDF File
Advancing Loans
Just as mobilisation of deposits gives resources for banking operations, advancement of loans gives monetary gain to the bank through interest charged on the loans. Commercial banks are known to provide mostly short term loans. Loans may be given in any four following forms.

Figure 3 shows the UI feature of the Bookroll platform for accessing the augmented podcasts. At the top of the page, accessibility features such as full-screen, zoom-in, zoom-out, and search are provided. Besides these, an audio player with essential features such as play/pause and forward/backwards are available. The PDF is visible below the accessibility and audio tabs. Users can change the page by scrolling up and down, and they can navigate to the next or previous lecture with the arrow button.

Participant profile

The experiment employed purposive sampling to ensure that the participants were well-suited for the objectives of the study. An institute from Mumbai (1-tier city), known for its vibrant educational landscape and diverse student population was selected as the setting of the experiment.

The institute, located in the central and well-connected area of Mumbai, offers undergraduate and postgraduate programs in various domains. For this study, the focus was on undergraduate programs within the domain of commerce and banking. In the institute considered for study, students of B.Com Banking & Insurance were found to be a good fit. This selection was guided by the objectives of the study, which focused on media and its impact on achievement through test scores. The study compares two groups viz the Control group and experimental group. The control group (AV) consisted of 27 students, and the experimental group (AP) consisted of 35 students. Each group consisted of a balanced mix of male and female students. Due diligence was taken during the group formation that the groups were representative of the population under consideration.

Rationale for Conducting the Pilot in a Tier-1 City

The decision to conduct the pilot study in a tier-1 city was strategic and aimed at eliminating extraneous variables that could have confounded the study's findings. Factors such as inconsistent network speeds, data limitations, and infrastructural disparities often pose significant challenges in lower-tier cities and rural areas. By ensuring a stable digital infrastructure in the pilot phase, we were able to control for these external influences, allowing the study to focus exclusively on the comparative effectiveness of Augmented Podcasts (APs) versus traditional video-based learning.

Furthermore, this approach was instrumental in assessing usability, engagement, and pedagogical effectiveness under optimal conditions before considering wider implementation. The pilot study's insights serve as a foundation for future scalability, particularly for tier-2 and tier-3 cities, where bandwidth constraints and data costs remain substantial barriers to digital education. By first refining the design, content delivery, and navigation features of Augmented Podcasts in an ideal setting, we could better anticipate the challenges and adaptations necessary for more bandwidth-constrained environments.

This systematic approach ensures that when Augmented Podcasts are introduced in low-resource settings, their usability

and pedagogical efficacy have already been optimized, making them a more viable alternative to high-bandwidth-dependent video content.

Research Design and Data Collection

The experimental group was exposed to Augmented podcasts, while the control group was exposed to the video-format lectures. The experimental and control groups were closely monitored throughout the study to ensure the integrity of the experiment. Measures were taken to prevent the exchange of content in both formats between the groups, thereby eliminating spillage or dilution of experimental conditions. The strict monitoring ensured that the findings accurately reflect the impact of these media on student achievement in the test scores across levels of question complexity, providing valuable insights into their effectiveness as educational tools.

The study utilised post-test design only experimental research design. The test was administered for both groups to assess their understanding and retention of the course content consumed using two media. The test consisted of eight items validated by the subject experts to ensure their clarity, relevance and alignment with objectives. The test comprised four questions of low difficulty level, 2 of medium and 2 of high difficulty level. as per the cognitive demands required to answer these questions. This 50 per cent-25 per cent-25 per cent distribution of questions helped to maintain the norms of question paper blueprint as well as formed the basis of nuanced analysis of student score/performance across varying degrees of cognitive challenge.

Table 1 shows the difficulty level of all eight questions. The difficulty level of the distribution of questions ensured that the placement of questions varied. The difficulty level was slowly increased starting with a low level in the beginning, gradually increasing it. The high difficulty level questions were concentrated towards the end. Initial gradation provided a flavour and tempo, the in between low difficulty level questions gave a breathing space considering the cognitive load of the media which was needed for the high difficulty level questions towards the end.

Table-1: Classification of difficulty level of each questions

Difficulty level of each questions								
Question No.	1	2	3	4	5	6	7	8
Difficulty Level	Low	Medium	High	Low	Low	Low	Medium	High

The test was conducted via Google forms seamlessly integrated into the LMS. This integration facilitated smooth administration and efficient data collection. The scores generated from these tests formed the primary data sets used to test the hypotheses of this study.

Ethical Considerations

As per the requirements of the Institutional Ethical Committee (IEC), due diligence was maintained regarding student privacy and data security. Student information and consent was collected using a form called a Participant Information Sheet (PIS) as per the specifications of the IEC. The data is stored on a password protected personal computer of the Principal Investigator. The data will be stored securely for the standard time requirements.

FINDINGS AND DISCUSSION

Data Analysis

This study employs a rigorous quantitative research approach, utilising both descriptive and inferential statistical methods to analyse the data collected from the tests.

Descriptive Analysis:

Descriptive analysis was conducted primarily through percentage calculations. This analysis served two key purposes:

1. Quantification of File Size Reduction: The second aspect involved quantifying any reduction in file size, which was relevant in assessing the efficiency and accessibility of the media formats used. Although this is more ancillary to the primary research question, it provided insights into the technical advantages or disadvantages of each media type.
2. Comparison of Correctly Answered Questions: The first aspect of the descriptive analysis focused on comparing the number of correctly answered questions between the experimental and control groups. This aspect is further done in three stages: (1) comparing percentages questions-wise, (2) comparing percentages lecture-wise, and (3) overall comparison of percentages. By calculating the percentage of correct responses for each group, the study aimed to identify trends and differences in performance that might be attributable to the use of different educational media (video/podcast).

The findings of the current research are based on two major aspects: the payload reduction and effectiveness of augmented podcasts. While studying the comparative effectiveness of augmented podcast vs video lectures, test scores are used as measurement.

Reduction in Payload

While designing and creating multimedia content for educational purposes, an important factor is the payload - the file size. Lower payload helps in increasing accessibility of content. The current study is guided by Research Question that studies payload reduction in a bid to bring forth this point.

RQ1: How much is the payload reduction when an audio visual is converted into a hybrid option of using augmented podcasts?

Table 2 shows the payload (file size) of augmented podcasts and that of the video lectures. It is evident that the payload reduction of augmented podcasts is 88 percent that of the video file.

Table-2. Reduction of payload

	Lecture 1	Lecture 2	Lecture 3	Lecture 4
AV Payload	249.0 MB	258.7 MB	237.8 MB	276.3 MB
AP Payload	27.7 MB	29.2 MB	28.1 MB	37.8 MB
Reduction in size	221.3 MB	229.5 MB	209.7 MB	238.5 MB
% Reduction	**88.8**	**88.7**	**88.1**	**86.3**
Average % Reduction	**88.023**			

Taking an instance, the course examined in this study consists of 36 lectures, with the average video file size being 250 MB. Making the total storage requirement for the video files to approximately 9,000 MB (9 GB). In contrast, the same content in audio format has an average file size of 30 MB. Therefore, the total storage required for the augmented podcast files is around 1,080 MB (approximately 1 GB). Which can potentially address the digital divide by consuming low data in the areas of low network connections and taking less storage space.

Analysis of test scores

RQ2: To what extent does the media (Video /Podcast) affect student test scores across different level of question complexity/difficulty?

The analysis of question wise score comparing the two groups was carried out for a finer understanding of the difference in the scores as per the difficulty level as well as to understand the trend, if any. For this, the tool Google sheets was used. The graphs give a vivid picture of the nuanced differences in the scores as below.

Figure-3: Question wise comparison of AP and AV scores

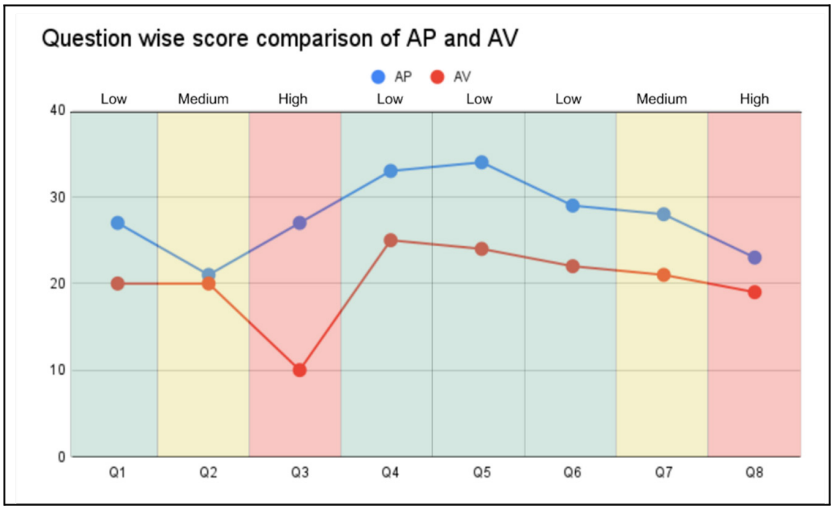

Figure 3 shows the graph mapping the scores with question numbers along with their difficulty level. It shows an observable difference in the scores of the two groups for every question, right from the first question, which was a low-level question. For the first question, the experimental group marked as AP in the legend scored higher than the control group labelled as AV in the legend. It is noted that the changes in the scoring pattern remain more or less the same irrespective of the media. The score displays a dip, a plateau and a rise at certain questions for both the groups. The analysis is indicative that in most cases, the difference in scores is dependent on the difficulty level of the questions and is independent of the media. There is an exception to this trend, as seen in Q.3, which is a high-level question. For this, there is a rise in the scores of the experimental group while a dip is observed in the scores of the AV group. Other than this, the scores followed the same pattern. In order to confirm this, a trend analysis was carried out.

Figure-4: Overall trendline of AP and AV scores

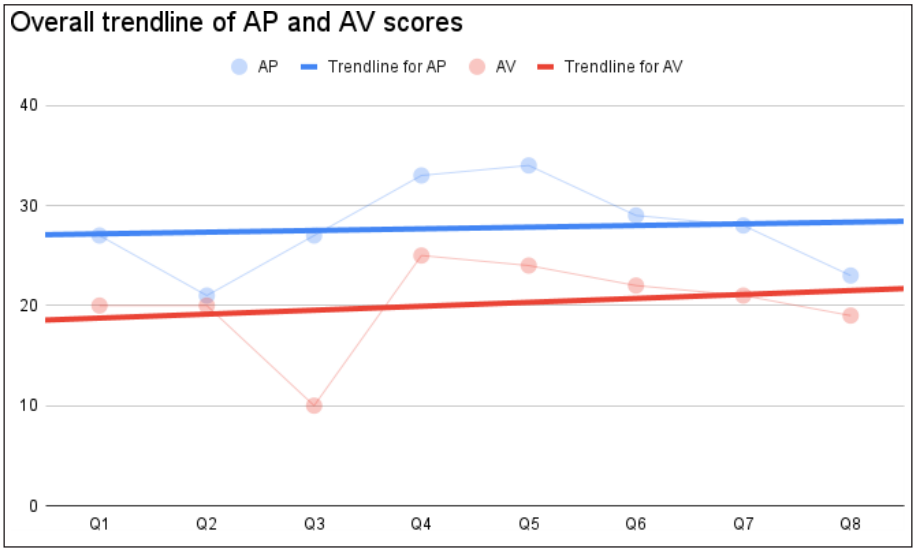

Figure 4 shows the trend analysis of the overall scores of the experimental and control groups. The trend lines confirm that both groups exhibit the same overall trend in their scoring. This is suggestive of the dependency of scores being independent of the media when seen overall. The gap in the trendline is indicative of the impact of the media. A tendency for scores to converge towards the average, thereby masking the distinct effects associated with varying question levels. Such findings underscore the importance of examining data at a more granular level to capture the nuanced impacts of media on high-, medium-, and low-level questions.

Questions 3 and 8 are both high-level questions. In question 3, there is a noteworthy gap in the scores of both groups. In question 8, the gap is similar to other questions. Upon further examination of the nature of both questions, it becomes evident that despite being categorized as high-level questions, they differ in the type of knowledge they assess. Question 3 requires the ability to synthesize complex concepts of policy and understand the relationships between ideas. Conversely, question 8 assesses higher-level classification integrating a factual recall. The consistent scores of the audio group in both questions could be because of the interactive nature of the audio + slides format, which allows learners to process information at their own pace. While video groups' drop in question requiring synthesizing could be because of the passive nature of the video while excelling in factual recall of question 8. It is clear that this necessitates further investigation in future research.

Descriptive Analysis of Quiz wise scores

The first step of determining effectiveness of the augmented podcasts was descriptive analysis of the test scores. Analysis was done question wise as well as lecture segment wise. The following tables show the analysis of the results.

Table 3 shows the percentages of question wise scores of both groups. It is worthwhile to note that the scores, which may be translated as engagement with media, remain consistent with the video lectures (AV group) for the first

two questions, unlike the augmented podcast (AP group). However, in Q.3 a sharp drop can be seen in AV, while AP remains consistent. It is evident from the table that though the students of the AP group showed lesser scores in the first two questions, the scores picked up in the next questions and remained consistent till Q.7. This hike in the AP group has dropped in the last question. In the AV group, from Q.4, there is a hike in the scores, which gradually decreases by Q.8.

Table-3: Quiz wise assessment scores of both the groups

		Q.1	Q.2	Q.3	Q.4	Q.5	Q.6	Q.7	Q.8
Question wise	AP	77.14%	60%	77.14%	94.29%	97.14%	82.86%	80%	65.71%
correct answers (%)	AV	74.07%	37.04%	92.59%	88.89%	81.48%	77.78%	70.37%	74.07%

Assessment scores of the students who took the augmented podcast and audio visual

Descriptive Analysis of Lecture wise scores

Table 4 shows the lecture wise percentages of scores of students of both groups. Each lecture had two questions based on the content. As noted above, in lecture 1 the percentage of students who gave the correct answer in group AP is lower as compared to group AV. After that, the percentages for lecture 2 are higher for group AP as compared to group AV. For lecture 3, a hike in the percentage of students with correct answers can be seen in both groups. For lecture 4, both groups had almost the same number of students with correct answers.

Table-4: Lecture-wise assessment scores of both the groups

		Lecture 1	Lecture 2	Lecture 3	Lecture 4
Lecture wise of	AP	68.57%	85.71%	90%	72.86%
correct answers (%)	AV	74.07%	64.81%	85.19%	74.07%

Assessment scores of the students who took the augmented podcast and audio visual

Descriptive Analysis of Overall Scores

Table 5 shows the overall percentages of both the groups. The overall score of AV is lesser than AP by almost 5 per cent.

Table-5: Overall assessment scores of both groups

Assessment scores of the students who took the augmented podcast and audio visual

Overall of correct	AP	79.29%
answers (%)	AV	74.54%

This difference in the percentages scores is pronounced due to the initial low scores in AV, which undermined the increase in the latter questions.

The above descriptive analysis shows that overall both the groups have performed equally irrespective of having different media to learn.

Inferential Analysis

At the outset, the collected data was checked for normality using the Shapiro-Wilk test (Khatun, 2021). The results revealed that the data collected was non-normal. This led to the application of Mann Whitney U test for inferential analysis. Mann Whitney U test is particularly suited for situations where the assumption of equal variances between groups may not hold, making it a robust choice for analyzing the test scores (Milenović, 2011). By comparing the scores of the two groups, the Mann-Whitney U test provided insights into the effectiveness of video versus podcast formats in enhancing student test scores.

This test was conducted to test hypotheses regarding the impact of the media formats on student test scores. The test was conducted on the scores obtained from both the experimental and control groups. This analysis aimed to determine whether there were statistically significant differences in performance between the groups that could be attributed to the use of different media formats.

Overall, this combination of descriptive and inferential analyses allowed for a comprehensive examination of the data, enabling the study to draw meaningful conclusions about the impact of educational media on student performance across different levels of question difficulty.

In order to further consolidate the findings, inferential analysis was carried out. This analysis was done for all three levels. Scores of each student for all the questions of the same level were summed together for both the groups. The Mann-Whitney was done between these level wise scores AP and AV.

Low-level questions

Question 1, 4, 5 and 6 were the low level questions. Table 6 shows the sum of all low level questions of each student in both the groups. As the data is not normally distributed Mann-Whitney U test was done.

Table-6: Scores of all low level questions in both the groups

Total assessment scores of the students for all low level questions who took the augmented podcast and audio visual

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
																29	30	31	32	33	34	35						
AP	4	2	4	4	4	4	4	4	4	4	4	4	4	1	4	3	3	3	3	3	1	4	4	3	3	3	4	4
																			4	4	3	4						

Mann-Whitney U test: The 35 participants (M= 3.51, SD = 0.81) who received the intervention of augmented podcasts were compared with 27 participants (M = 3.37, SD = 0.83) who received instruction via video lectures. There was no significant difference in the test scores between the two groups

p = 0.4028. The result is not significant at p < 0.05.

From the analysis of the low level questions, it is evident that both media have worked equally well for the learning of the low level questions.

Medium level questions

Questions 2 and 7 were medium-level questions. Table 7 shows the sum of all medium-level questions of each student in both groups. As the data is not normally distributed, the Mann-Whitney U test was done.

Table-7: Scores of all medium level questions in both the groups

Total assessment scores of the students for all medium level questions who took the augmented podcast and audio visual

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
										30	31	32	33	34	35														
AP	0	1	2	2	2	2	2	1	2	2	1	1	1	2	0	2	2	1	2	2	1	1	1	1	0	1		1	1
										2	1	2	2	2	1	2													
AP	1	2	2	0	1	1	2	2	2	2	2	0	2	1	2	2	1	0	2	1	1	2	2	-	-	-	-	-	-
										-	-		2	2															

Mann-Whitney U test: The 35 participants (M= 1.4, SD = 0.65) who received the intervention of augmented podcasts were compared with 27 participants (M = 1.51, SD = 0.70) who received instruction via video lectures. There was no significant difference in the test scores between the two groups p = 0.3753. The result is not significant at p < 0.05.

From the analysis of the medium level questions, it is evident that both media have worked equally well for the learning of medium level questions.

High-level questions

Questions 3 and 8 are high-level questions. Table 8 shows the sum of all high-level questions of each student in both groups. Since the data is not normally distributed, the Mann-Whitney U test was done.

Table-8: Scores of all high-level questions in both groups

Total assessment scores of the students for all high level questions who took the augmented podcast and audio visual

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
										30	31	32	33	34	35														
AP	2	2	0	0	2	2	1	2	1	2	1	1	2	2	1	2	1	0	2	0	1	0	2	2	2	2	2	1	2
													2	2	2	1													
AP	1	2	1	2	0	0	0	1	0	1	2	0	1	1	1	1	1	1	1	1	2	2	2	2	1	-	-	-	-
													-	-	-	-													

Mann-Whitney U test: The 35 participants (M= 1.42, SD = 0.73) who received the intervention of augmented podcasts were compared with 27 participants (M = 1.07, SD = 0.67) who received instruction via video lectures. There was a significant difference in the test scores between the two groups p

= 0.0381. The result is significant at $p < 0.05$.

From the analysis of the high-level questions, it is evident that both media have not worked equally well for the learning of medium-level questions. This needs further investigation. It is evident that both media have worked equally well for the learning of low and medium questions.

Usability and Engagement

While videos offer a passive consumption model, Augmented Podcasts (APs) require active engagement through interactive elements such as synchronized transcripts, clickable timestamps, and supplementary resources. This additional effort in navigation is not a drawback but a feature that deepens cognitive engagement and enhances learning retention.

- Active Learning Over Passive Consumption: Unlike videos, which often lead to passive watching, APs require intentional interaction—skimming through transcripts, revisiting key points, and engaging with supplementary materials. This aligns with cognitive load theory, where controlled effort leads to better retention.
- Personalized Pace of Learning: APs allow users to navigate based on their needs, spending more time on difficult concepts and skipping familiar ones. This control fosters self-regulated learning, which research suggests enhances motivation and comprehension.
- Mobile Optimization & Usability: The argument that APs demand extra effort is mitigated by the fact that modern podcast platforms are designed for seamless tap-and-scroll interactions, making them just as easy to use as video platforms, if not more so. It was also possible for learners to annotate the pdf of the slides whenever they felt necessary. This feature of additional learner autonomy and responsibility is not available in the video format.
- Cognitive Load Reduction: Videos often integrate multiple simultaneous stimuli (visual, auditory, textual), which can overwhelm learners. APs break this down by separating audio track, and the visual slides, allowing for more focused and self-paced learning.
- Screen Independence: Learners with visual impairments or those in scenarios where screen use is impractical (e.g., commuting) benefit from the flexibility of APs.

Conclusion

This research provides important insights into student engagement with augmented podcasts and video lectures, demonstrating that both media effectively support learning, though their strengths may vary depending on the complexity of the content. While no significant differences were found in test scores between learners who used podcasts and those who used videos in low- and medium-difficulty tests, a difference emerged in high-difficulty tests, where videos slightly outperformed podcasts. However, this does not diminish the potential of augmented podcasts, especially when paired with supplementary PDFs, which allow for content delivery that is both efficient and effective.

Augmented podcasts proved to be a novel and comparable alternative to video lectures, particularly for content that is less complex and does not rely heavily on visual elements. The combination of audio with text-based materials allows learners to engage deeply with the content, without the distractions that sometimes accompany

video-based learning. Their reduced data load makes them an ideal, low-bandwidth alternative, offering significant advantages in overcoming digital divide issues, particularly in regions where internet access is limited or unreliable.

For educators and curriculum designers, these findings highlight the importance of not relying solely on video lectures. Incorporating augmented podcasts into the curriculum can enhance accessibility and engagement, particularly for content that can be conveyed effectively through audio. The results of this study invite educators to re-examine how different media can serve different educational needs, encouraging a more balanced and inclusive approach to instructional design.

Future research should continue to explore the impact of these media by focusing on the qualitative experiences of students using augmented podcasts. Such studies would help uncover further nuances in student preferences and media consumption patterns, ultimately guiding the development of more personalised and effective educational content. Further research should also explore the impact of these media on other subjects which rely heavily on visual elements.

Future Research Directions

While this study establishes the usability and effectiveness of Augmented Podcasts (APs) in a controlled learning environment, certain aspects require further exploration. One key area for future research is optimizing APs for mobile accessibility. While it is currently functional on mobile devices, its seamless navigation, integration with learning management systems, and user experience across different screen sizes and operating systems warrant deeper investigation.

Additionally, transcripts and assistive features can enhance the accessibility of APs, particularly for learners with hearing impairments. Future research can explore how synchronized transcripts, interactive transcripts, or AI-generated captions may contribute to inclusivity without compromising engagement.

LIMITATIONS

Despite its contributions, this study has certain limitations. The study was initially conducted in a tier-1 city, where infrastructure issues like low bandwidth or unstable connectivity were not a concern. Although this helped control for extraneous variables, future research should examine APs in tier-2 and tier-3 cities to assess their real-world effectiveness across varied digital environments. This consideration was incorporated in the later stages of the experiment. This paper presents findings from the pilot study, which is part of a larger research project.

This study focused on concept-heavy content, where APs may serve as a viable alternative to videos. However, for visually intensive subjects (e.g., engineering diagrams, medical imaging), APs may have inherent limitations. Further research should investigate their applicability across different disciplines.

While APs encourage active engagement through navigation, the additional cognitive effort required might be a barrier for some learners, particularly those accustomed to passive video consumption. Future research should examine user preferences, cognitive load, and engagement levels in different learner populations.

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Review Article

Hybrid education in the age of Education 5.0- A study of engagement and innovations in the Indian education system amidst covid-19

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Abstract

Amidst the global pandemic, the landscape of education witnessed a seismic shift, compelling both students and educators to embrace digital platforms for learning. Education 5.0 emerged as a beacon of hope, offering innovative solutions to navigate the challenges posed by the COVID-19 scenario. This paper presents an overview of the educational sector, focusing on the engagement and innovations that shaped hybrid education in the Indian Education System during the pandemic.

Investigating the form and effectiveness of digital platforms, the research explores their benefits as vehicles for exchanging information. Additionally, it highlights the pivotal role of AI in Education 5.0, empowering educators with data-driven insights and personalized support through digital platforms. The study also explores the transformative potential of blended learning, envisioning a paradigm shift in India's educational ecosystem through education 5.0- Faculty-student engagement model with the addition of Blended learning and Artificial Intelligence.

Through this exploration of engaging pedagogies and cutting-edge technologies, the paper underlines the resilience of the Indian Education System amidst adversity.

Keywords: Blended learning, pandemic challenges, faculty and student engagement, innovations in higher education, artificial intelligence

Introduction to Digital Engagement in the Higher Education Sector

Just like social engagement, the word 'digital engagement' is often used for any use of social media by an organization to promote the participation of its stakeholders. For a business organization, its stakeholders are customers, employees, management, shareholders, suppliers, government, etc, and for an educational organization, its main stakeholders are its faculty and its students, along with its management. COVID-19 is considered a 'black swan'. The very first feature of a 'black swan' is the uncertainty in their occurrence, and the second key feature is that the impact of their occurrence is very big, just like any terrorist attack in the past or any global financial recession (Erken et al., 2020).

Digital engagement is a very complex topic, and two modes of engagement, offline and online, are responsible for engaging people on digital platforms (Hecht, 2014). Covid 19 has a great

impact on Global education and its learners. Global statistics by UNESCO show that about 1.38 billion learners are being affected by the pandemic situation (Li and Lalani, 2020).

The hunt for talent will become difficult, and organizations will be compelled to ensure the engagement of existing employees to drive performance and sustain competitive advantage (Mukherjee, 2014). It is not the engagement of people, but the engagement of the digital age, which requires a framework of thoughts, strategies, and innovation. The digital platform has been successful in engaging the faculty as well as students through various tools such as WhatsApp, which is one of the most used messaging apps in the world. Nowadays, it is used mostly by students and staff, acting as a topmost social platform. Presently it has become a successful medium to exchange information, especially in the education sector. On the other hand, Facebook has become a dominating social media app that has just increased its branches in one or the other way. It is not only providing opportunities to marketers or businesspersons but also innovators and educators. The LinkedIn account always acts as a network where professionals can share their thoughts on learning, innovation, and teaching. One can say that Twitter acts as the best place for digital engagement connecting people globally. Today teachers are finding YouTube as the best way to connect with students globally (Stoller, 2019).

Objectives of the Study

1. To study the importance of digital engagement and how it acts as an opportunity or a challenge in the education sector during the Covid-19 period.
2. To study different online innovative modes and platforms that have been successful in the engagement of faculty and students during the pandemic at the global level.
3. To discuss a hybrid education framework adopted by the Indian education system under Education 5.0 after COVID-19 with the inclusion of artificial intelligence (AI) to engage the faculty and students for the long term.

Research Methodology

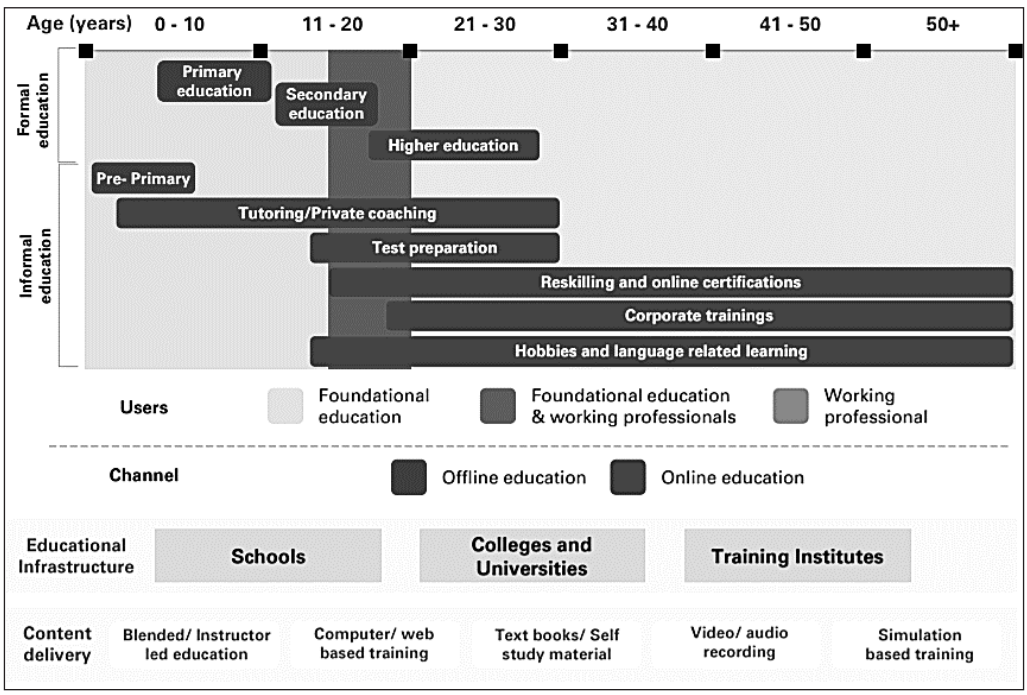
For a deeper understanding of the higher education sector and faculty and student engagement on the digital platform, this paper compiles relevant material with the aid of sixty-three pieces of literature, including book chapters, articles, and research papers. EBSCO, ProQuest, and Web of Science databases were used to search the literature on teacher and student participation. This research adapts a systematic assessment approach suggested by Cerchione and Esposito (2016), Easterby-Smith et al. (2012), Petticrew & Roberts (2006), and Pittaway et al. (2004). Thus, the research is segmented into certain phases such as keyword research, database selection stage, inclusion and exclusion of the literature based on the definitions, analyzing and classifying the selected publications, and lastly the content analysis by examining the publications and categorizing the subjects. A structured review strategy is being adopted by implementing manual filtering and transparency (Tranfield et al., 2003).

Overview of the Education System in India before the Emergence of Covid-19

A study conducted by KPMG in India and Google shows that India has a complex or one can say multiple-

layered structure, where the formal educational structure is placed upon primary schools, secondary schools, graduation, post-graduation, and other degree courses, where the governing bodies are central or state governments. The University Grant Commission plays a very important role in the higher education sector. Informal education includes coaching, private mode of tuition, online certification courses, training programs, etc. It can be seen in Figure 1 that online education was only a part of informal education before Covid-19. The Indian education system has always relied upon only the physical mode rather than the online mode, whether it is a question of physical classes, or examination system, or a student evaluation system. The online channels in India were mostly used either for marketing or business purposes (All India Survey on Higher Education, 2015; Online Education in India, 2017).

Figure-1: Education system in India before Covid-19



(*Source: All India Survey on Higher Education, 2015; Online Education in India, 2017*)

Figure 1 reveals the educational landscape across different age groups and shows the progression in formal education from pre-primary to higher education, along with informal learning opportunities. It also differentiates between the foundational education for children and professional development for adults, thus showcasing the mixture of offline and online educational channels with schools, colleges, and training institutes as different types of infrastructures in education. Content delivery methods from the traditional instructor-led approaches to the modern approaches are also explained here, and thus, Figure 1 focuses on the continuity in the learning process throughout one's life at different stages of learning (All India Survey on Higher Education, 2015; Online Education in India, 2017).

But the emergence of the pandemic has completely transformed the scenario in the education system. In the last hundred years, no one has thought that the world would ever face such a situation where people can't move out for education or work. Now, the education sector is more focused on online teaching and tools than physical teaching. Earlier, virtual teaching was just considered as an option for distance learning or any other training course, but now it has become a compulsion.

Digital Engagement and Its Stakeholders in Higher Education

There are different stakeholders in the higher education sector, such as students, teachers, investors, government, non-government organizations, administration, employers, suppliers, management, and even parents (Speck, 1996). However, keeping in mind the pandemic situation, the most important stakeholders connecting education and digital engagement are management, government, faculty, and students. The most important role is played by a faculty member who connects with the students, motivates them, and makes the best use of different pedagogy tools to teach them (Marshall, 2018). Covid-19 has completely transformed the scenario of teaching at the global level. Today a teacher has become a digital teacher by providing the students with virtual classes, engaging the students on the digital platform, sharing the e-content with them, interfacing with the application-based evaluation system, and much more (Brown, 2021).

Three basic pillars of the education system in India in the pandemic are:

1. **Curriculum (Models Defined By UGC and AICTE)**

   It includes all the immediate guidelines given by the UGC and AICTE to all the colleges and universities at the time of emergency lockdown in the pandemic, which was the need of time. These guidelines included all the instructions regarding online classes, online exam conduction, and e-content sharing.

   The details of some of the UGC letters communicated immediately to the employees and the students after the COVID-19 outbreak:

   a. UGC Letter Dated 25th March 2020 regarding ICT Initiatives of MHRD and UGC. The details of all the platforms mentioned in the letter were shared with both the faculty as well as the students. The various online platforms are Swayam online courses, UG/PG MOOCS, E-Pathshala, Swayam Prabha, UGC YouTube channels, Shodhganga, National Digital Library, E-Shodh Sindhu, Vidwan, etc. (University Grant Commission, 2020)

   b. UGC Letter Dated 28th March 2020 where an appeal was made for a Contribution to COMBAT COVID-19 with one day's salary by the employees to provide financial help for the Nation (University Grant Commission, 2020).

   c. The UGC Letter Dated 28th March 2020 provides the UGC Quality Mandate to suggest various activities be completed within the semester to improve the quality in the Higher education sector and to face the different challenges like employability, quality teaching, ICT Tools, course completion, etc (University Grant Commission, 2020).

3. **Conduction of Classes on the Digital Platform**

   The second most important pillar of the Indian education system in the pandemic was the education regarding the digital platforms available for the conduction of classes such as Skype, GoToMeeting, Zoom, Cisco Webex, WhatsApp, Google Meet, free Conference.com, etc to engage the students as well the teachers which could have otherwise hampered the teaching-learning process. Video lectures and live streaming on YouTube or Facebook are also a part of the online platforms.

4. **Evaluation (Online Assessment Tools For Teachers For The Quiz, Grades, Tutorials, Material Sharing, etc.)**

   The third pillar is the availability of online assessment tools required by teachers to assess the performance of the students without their physical presence for examination. Different online tools such as Google Classroom, Moodle, Microsoft Whiteboard, Hot Potatoes, quizzes, Google Forms, and Microsoft Teams were being introduced to the teachers for online content sharing, examination, and grading system which in turn is acting as a boon for them.

New Opportunities for Faculty and Student Engagement in Higher Education through a Digital Platform at the Global Level

One cannot deny the fact that Higher education is moving from the adoption of old teaching methods to new innovative teaching techniques. Teachers are actively engaged in more sophisticated tools to instruct the students (Soni, 2020). UNESCO just came up with different platforms to help parents, teachers, and students provide a solution for learning and teaching opportunities in the time of social distancing.

Table-1: Online learning management system given by UNICEF

S. No.	Digital Learning Tools	Application
1.	Century-Tech	Teaching and learning platform through artificial intelligence
2.	Class-Dojo	A platform to connect parents, teachers and students through online mode
3.	Ed-modo	A platform to connect parents, teachers and students through online mode and helps in sharing e-content
4.	Google-Class	A learning management system to connect parents, teachers and students through online mode and helps in sharing e-content and managing assessment
5.	LMS-Moodle	A learning management system to connect teachers and students through online mode and helps in sharing e-content and managing assessment
6.	Paper-Airplanes	Offers sessions on English through online platform

S. No.	Digital Learning Tools	Application
7	School-ogy	A learning management system to connect teachers and students through online mode and helps in sharing e-content and managing assessment
8	See-saw	An online tool to connect teachers and students through online mode and helps in sharing e-content and managing assessment.
9	Skooler	A learning management system to connect teachers and students through Microsoft.

Source: UNESCO, 2021

Table-2: Collaboration online platforms for communication and interaction

S. No.	Digital Collaboration Platforms	Application
1.	Ding-Talk	Free online platform for communication
2.	Lark	A communication tool for messaging, conferencing, and data exchange
3.	Google-Hangouts	Video calling, chats, and voice calls
4.	Microsoft-Teams	A communication tool for messaging, conferencing, and data exchange
5.	Skype	Video calling, chats, and voice calls
6.	WeChat-Work	Communication and corporate tool for workplace
7.	WhatsApp	A communication app for messaging, calling and data exchange
8.	Zoom	A platform for messaging, conferencing, and data exchange

Source: UNESCO, 2021

Table-3: Tools for creating e-content

S. No.	Digital Tools For Teachers	Application
1.	Thing-link	A tool or an app to create images, videos, etc
2.	Buncee	e-content sharing through innovative virtual presentations
3.	Ed-Puzzle	e-content sharing through innovative virtual presentations by connecting them with LMS
4.	Kaltura	Video creation tool and connects with LMS
5.	Near-pod	Interactive presentation and video creation tool
6.	Pear-Deck	Interactive presentation and video creation tool
7.	SQUILL	A tool converting the content into interactive presentation through artificial intelligence
8.	Trello	A collaborative tool for designing courses and managing classes.

Source: UNESCO, 2021

"UNESCO is not only guiding about all these tools and applications but also providing mental support to parents, students, and teachers at the global level to eradicate any kind of panic. It is also creating awareness regarding child support and health in the pandemic (UNESCO, 2021). All the above-mentioned tools are being followed by different educational stakeholders worldwide which has somewhat reduced the problem of content sharing as well as communication.

Covid-19 as a Catalyst in Faculty and Student Engagement

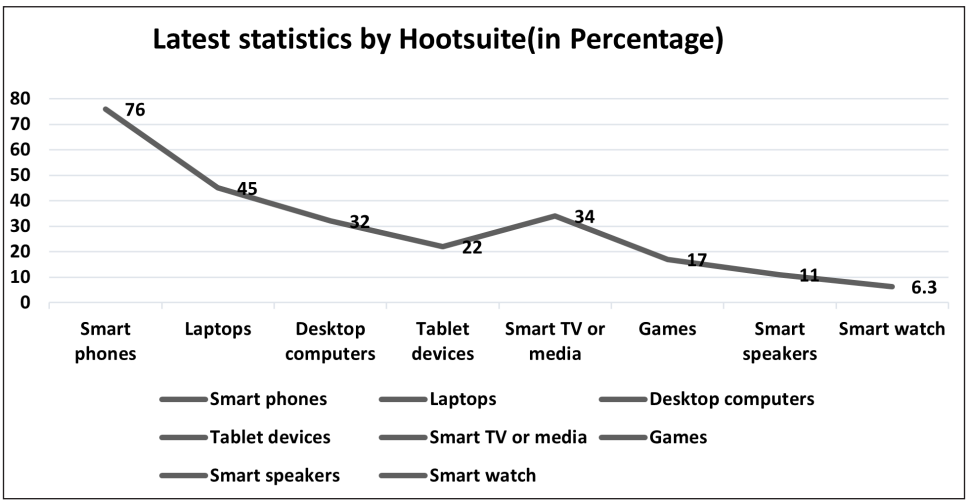
This pandemic has acted as a catalyst in engaging the faculty and students on a digital platform. These online tools and techniques are acting as an omnichannel in the education sector. Digital global reports by Statshot in 2020 show how the digital world has grown at the global level at a very fast pace. Table No. 4 and Figure 2 clearly show how people have increased their usage of the internet, mobile phones, and social media during the pandemic.

Table-4: Global digital growth (During the Pandemic)

Statistics by Hootsuite	Total Population	Mobile phone users	Internet users	Social media users
April 2020 vs. April 2019	+ 82 Million	+128 Million	+301 Million	+304 Million
Digital Growth	1.10%	2.50%	7.10%	8.70%

(Source: Kemp, 2020)

Figure-2: People spending their time with online devices after the emergence of COVID-19



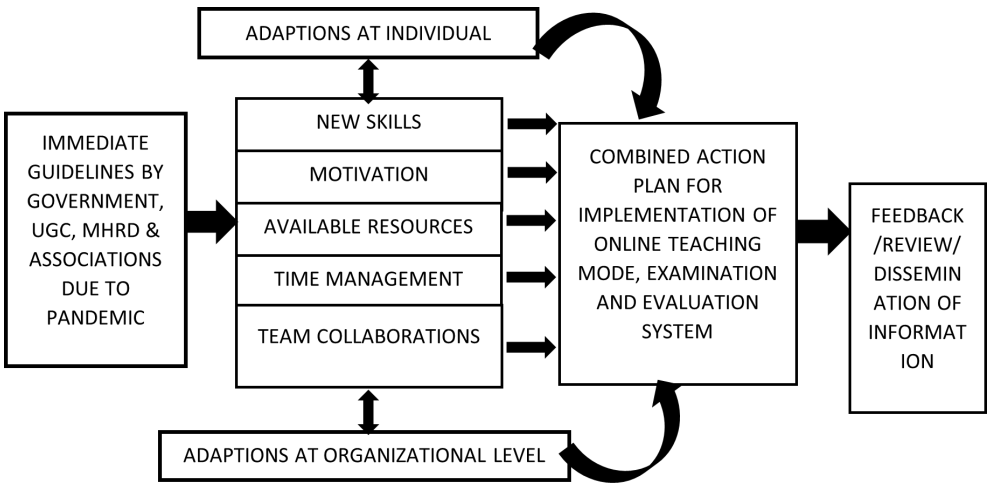
(Source: Kemp, 2020)

In one of the surveys, Figure 2 shows that by April 2020 users aged 16 to 64 years in countries like Australia, Brazil, India, China, France, Canada, Germany, Ireland Italy, New Zealand, Philippines, Singapore, Spain, UK, South Africa, and the USA started spending more and more time on the digital devices like smartphones, laptops, computers, tablets, gamification, smartwatches, etc at the global level (Kemp, 2020).

New Engagement Model Adapted in the Education Sector in Covid-19

The pandemic situation forced everyone to come up with novel ideas, tools, technologies, and technologies to adjust to the changing environment and to face this challenge even if the students and teachers were not computer savvy in most of the areas and cases, and that too in a very short period. The changes are to be implemented in a very short period with high accuracy as it is a question of the education sector that is the future of any country. So, a new education online system is mostly adopted in the current situation as shown in Figure 3 keeping in mind the previous education models suggested by different researchers (Speck, 1996; Mishra et al., 2020).

Figure-3: Adapted Faculty-student engagement model through digital platform in COVID


ADAPTIONS AT INDIVIDUAL
IMMEDIATE GUIDELINES BY GOVERNMENT, UGC, MHRD & ASSOCIATIONS DUE TO PANDEMIC
NEW SKILLS
MOTIVATION
AVAILABLE RESOURCES
TIME MANAGEMENT
TEAM COLLABORATIONS
COMBINED ACTION PLAN FOR IMPLEMENTATION OF ONLINE TEACHING MODE, EXAMINATION AND EVALUATION SYSTEM
FEEDBACK /REVIEW/ DISSEMIN ATION OF INFORMAT ION
ADAPTIONS AT ORGANIZATIONAL LEVEL

(Source: Adapted from Speck, 1996 and Mishra et al., 2020)

Figure 3 shows a comprehensive model for adapting educational systems to online platforms during the COVID-19 pandemic, with the outbreak of a pandemic, the education system has to completely rely on the online system (Speck, 1996; Mishra et al., 2020).

1. Initiating Factor

Immediate guidelines were issued by the Indian government, UGC, and MHRD, which pushed the education stakeholders like faculty, administration, leaders, collaborators, students as well as parents to adapt themselves at the individual as well as the organizational levels with novel skills, limited resources keeping in mind the time constraint.

2. Key Components

The key components of this model were:

New Skills: Educators, as well as students, needed to acquire digital literacy in a short time.

Motivation: Maintaining engagement and drive in a novel and potentially **challenged environment.**

Available Resources: Identifying and utilizing accessible digital tools or platforms.

Time Management: Adapting to the new schedules and balancing different responsibilities in remote settings.

Team Collaboration: Fostering virtual teamwork and proper communication among the educational stakeholders.

3. Central Action

The combined action plan included the implementation of online modes of teaching, online examination systems, e-content sharing, online examination modes and methods, effective online evaluation system which can effectively engage the faculty as well as the students at the online platforms. Finally, a regular feedback system that can act as a watchdog.

4. Dual Adaptation Levels

Adaptation at an individual level: The knowledge of the digital platform became a necessity not only in the agriculture sector or IT sector but also in the education sector and thus, an attempt was made to train students as well as teachers so that they may acquire knowledge of ICT Tools and techniques with the already existing resources (Singh, 2012). The situation is just like war after a pandemic, so everyone must work as a team and, most importantly, work according to the time available.

Adaptation at the organizational level: All educational institutions, as well as the universities, must change their mode of instruction, feedback, and collaboration methods to achieve quick goals which are not possible without top-level management support, administrative staff, students as well as teachers' support.

The circular arrows indicate that these adaptations continuously affect and refine the action plan.

Outcome

Due to the lack of face-to-face interaction between educational stakeholders, it became very necessary to take timely feedback to improve the processes on time. The final stage involves data collection in the form of feedback and reviews on the effectiveness of the implemented changes, their analysis, and dissemination of the information for the further improvisation of the system.

Thus, this model provides a holistic approach, recognizing the successful transformation to online education.

The Challenges in Faculty and Student Engagement at Digital Platform

There are different challenges in adopting the online platform for learning as most of the learners are struggling at the global level without internet facilities as well as proper training on online platforms. The usage of the right technology may lead to more effective learning (Li and Lalani, 2020).

In the digital era, everything can be done in the blink of an eye and has become a new rule for everyone. The new generation is living up to the latest gadgets, iPhones, laptops, smartphones, and the internet, which have reduced the need for physical infrastructure. The mode of study of language communication and social interaction has completely changed. In the last few years, universities like Harvard have developed different innovative strategies to connect faculty and students (Hewitt, 2014).

The students at an institute or a university are its assets. Some of the previous studies show that the e-learning methods have not shown consistent results in increasing the productivity of students in Academics. So, the researcher conducted a study on undergraduate students at a Korean University and thus measured student engagement on the digital platform. This study revealed that the students believe that their online assignments completely engaged them during their classes. But this study was also conducted on campus (Kim et al., 2019).

Different barriers act as a challenge in adopting a digital platform for learning. Some of the challenges on the part of

learners and teachers are as follows (Swan, 2017; Singh & Tiwana, 2018; Chen et al., 2022):

1. One of the challenges is to handle the weak students as compared to the average or brilliant students through the online platform.
2. Another challenge is related to the assignments that must be completed in teams or groups with zero defects, where learners may face technical and coordination issues.
3. The complete engagement or attentiveness of the student while attending the class is always questionable, as there is no face-to-face interaction between the learner and the teacher.
4. Another major issue is the promotion of quality writing among students who have become so technology savvy that they may forget writing in academics.
5. If there are no media or devices, then how will a student learn? This can also act as a great challenge.
6. Finally, there are technical issues like the unavailability of internet facilities in remote areas.

Not all the teachers and students are computer savvy, and some of the courses need only physical classroom teaching. Apart from the above challenges, nowadays, everyone is facing security issues related to the internet and devices, and one has to face unethical hackers in this field (UNESCO, 2021). As India is the second most, after China, in the Top 20 nations in having Internet facilities, the challenges faced may be less as more than 95 per cent of users in India have access to mobile phones while 93 per cent of the higher education students use the Internet daily (Internet world stats, 2020).

Is the digital platform successful in engaging the faculty and students?

This question is ironic. In the period of Covid-19, with the adoption of technology, education has completely transformed from teacher-centric to teacher- student-centric education. Virtual classrooms and innovative online tools help to engage faculty as well as students just like a real-time classroom. The only thing that Digital education requires is the coordination between reliable course content, faculty dedication, reliable technology, dedicated students, and, most importantly, an easily available internet connection. Covid-19 brought in a lot of uncertainties. While office-going employees are adapting to the remote work culture, colleges, and universities are embracing online learning modules and discussions. For many, the lockdown has resulted in an uncertain examination schedule, lost internship opportunities, and the pulling back of job offers (Dhawan, 2020). However, the main question of the reliability of digital platforms will always remain unsolved as everyone will agree with the fact that for a successful digital engagement, a learner or an instructor must also be honest.

Shadow of Education 5.0- Blended Mode of Learning

Education 5.0 evolves from Education 4.0 by emphasizing a human-centric approach, focusing on social and emotional skills, and promoting environmental consciousness for a sustainable future. Blended learning is not just the combination of the offline mode and the online mode of learning but also includes all those activities that drive teacher-student engagement with more effective results. The University Grants Commission (UGC) on 20th May 2021 released a concept note for the implementation of a blended mode of learning – a mix of online and offline education – in universities with the

following proposed guidelines (Kalita, 2021):

1. Syllabus Completion

According to this concept note, higher education institutes will be allowed to teach up to 40 per cent of each course, other than SWAYAM courses, online, and the remaining 60 per cent syllabus of the course can be taught offline which can act as a boon in the education sector.

2. SWAYAM Platform

The new provision that may make up to 40 per cent of online education permissible for SWAYAM courses is also very desirable as this change will transform passive learners into active learners.

3. Proper Infrastructure For ICT Preparations

Before implementing blended learning, proper time must be given to prepare educational institutions to prepare for online teaching and learning, as earlier, online teaching was not a part of the curriculum. Blended learning will require proper computer labs and teaching tools. As mentioned in the concept note, proper infrastructure facilities such as LMS, ERP, WIFI, Bandwidth, smart classes, data service centres, and studio facilities are to be taken care of.

4. Proper Planning

Proper planning on the part of a university or a college will be required for the introduction of blended learning as the incremental learning process will reduce the chances of failures.

5. Proper Training

To introduce this learning model in education, the students and teachers will require proper training and education.

6. Assessment and Evaluation

Another important point discussed in the concept note focuses on the online assessment strategies to be followed partially in all the subjects. Rubrics should be developed for the assessment including projects.

7. Effective Feedback

Course-related feedback, 360-degree feedback, and student feedback must be taken regularly (2-3 times a semester) to monitor the flaws or the progress of the learning system.

8. Flexible Course System

A flexible course system will help the students to discover themselves and expand their horizons. This flexible system will also be very helpful in times of lockdown or other emergencies where a complete syllabus is to be taught through online mode.

9. New Room for Innovations

The blended learning model will open new rooms for innovative tools and techniques and more autonomy in teaching and learning processes.

New Era of Artificial Intelligence-Education 5.0

In the realm of Education 5.0, Artificial Intelligence (AI) has emerged as a game-changer, revolutionizing the field of education with its profound contributions. One of the key contributions of AI in Education 5.0 is its ability to analyze vast datasets to identify learning gaps and design targeted interventions. Chen and Liu (2021) conducted a comprehensive survey on AI in education, highlighting how AI-powered algorithms can process massive amounts of student data, including assessment scores, learning behaviors, and preferences. By analyzing this data, AI algorithms can pinpoint areas where students are struggling,

enabling educators to tailor their teaching approaches and resources accordingly. One of the projects, Udaan, launched by IIT Bombay in India, is an AI-based Translation ecosystem designed to translate scientific or technical content from English to different Indian languages by reducing the translation time and efforts (Indian Institute of Technology Bombay, 2021). Even IIT Madras is developing a virtual reality-based education model for rural schools that helps the students learn and conduct experiments. This initiative also includes the mobile application "Memory Bytes" to bridge the digital issues in the future (Indian Institute of Technology Madras, 2023).

Another noteworthy contribution of AI in Education 5.0 is the development of AI-powered chatbots and virtual tutors. Martin et al. (2022) explored the potential of chatbots as virtual tutors and found that these AI-driven tools offer real-time support to students. These chatbots can answer queries, clarify doubts, and provide guidance on various topics, promoting continuous learning beyond the confines of traditional classroom hours. In India, AICTE (All India Council for Technical Education) entered a partnership with Microsoft on 25th September 2024 to enhance skills and employability among students and teachers by providing certifications, mentorship, AI Cloud, hands-on learning through platforms like Microsoft Learn and Azure Developer Community (Ministry of Education, AICTE, & Microsoft, 2023).

Furthermore, AI has streamlined the assessment and feedback mechanisms in Education 5.0. Wang et al. (2023) investigated the integration of AI in assessment practices and reported that AI-powered systems can automatically grade assignments, quizzes, and exams with high accuracy. This automation not only saves valuable time for educators but also provides timely and constructive feedback to learners. Instant feedback is instrumental in helping students understand their mistakes, make improvements, and progress in their learning journey. It also allows educators to track student progress effectively, enabling targeted interventions when needed.

Thus, artificial intelligence has significantly transformed Education 5.0 by empowering educators with data-driven insights, providing real-time support to students, and streamlining assessment processes. The personalized learning experiences facilitated by artificial intelligence-driven educational technologies ensure that each student's needs are met, enhancing overall learning outcomes (D'Mello and Calvo, 2011; Johnson et al., 2016; Siemens and Baker, 2012). As artificial intelligence continues to advance, its role in education is likely to expand further, promising an exciting future for the evolution of Education 5.0.

Additionally, such analytics enable the identification of at-risk students, allowing for timely interventions and support systems (Romero and Ventura, 2010).

In terms of innovation, Education 5.0 can facilitate the development of intelligent tutoring systems that simulate human-like interactions and adapt to students' needs, fostering deeper engagement and improving learning outcomes (VanLehn, 2011). Technologies such as virtual reality (VR) and augmented reality (AR) can also create immersive and interactive learning environments, enabling students to explore complex concepts in a hands-on manner (Chen et al., 2016).

AI Tools and Post-Pandemic Innovations In Shaping Hybrid Education Models (2021-2024)

Table No 5 reveals the key contributions of artificial intelligence in improvising the hybrid education experience during and after the COVID-19 pandemic. Every facet of hybrid education has been transformed by AI tools and post-pandemic pedagogical innovations, more adaptable, personalized, and comprehensive education environment.

Table-5: AI Tools and Post-Pandemic Innovations in Shaping Hybrid Education Models (2021-2024)

Aspect	Researcher	Artificial Intelligence (AI) in Education	Post-Pandemic Pedagogical Innovations	Impact on Hybrid Education	Tools Used
Learning Experience	Chen et al. (2020); Ouyang & Jiao (2021); Holmes & Tuomi (2022); Acosta et al. (2023); Carius (2021); Moorhouse et al. (2023); Pathiranage & Karunaratne (2022).	Personalized learning paths, Intelligent tutoring systems, Adaptive assessments.	Shift towards student-centred learning, Increased emphasis on self-directed learning.	Blended learning models combining online and in-person instruction, Flexible learning environments.	Learning Management Systems (LMS), Virtual Reality (VR) and Augmented Reality (AR) platforms, AI-powered educational apps.
Teaching Methods	Grassini (2023); Mirzaeian et al. (2016); Olszewska (2020); Chin et al. (2019); Sangster et al. (2020); Zhao & Watterston (2021).	AI-assisted content creation, Automated grading and feedback.	Flipped classroom approaches, Project-based and problem-based learning.	Synchronous and asynchr-onous teaching methods, Increased use of multimedia and interactive content.	Video conferencing tools (e.g., Zoom, Microsoft Teams), Interactive whiteboards, AI-powered content recommen-dation systems.
Student Support	Narayanan et al. (2023); Huang (2024); Carius (2021); Grassini (2023); Khedrane (2024); Holmes & Tuomi (2022).	AI chatbots for student queries, Early warning systems for at-risk students.	Virtual office hours and online mentoring, Peer-to-peer online support networks.	24/7 access to learning resources and support, Seamless integration of in-person and online support services.	AI-powered chatbots, Online collaboration platforms, Learning analytics dashboards.
Assessment and Feedback	Ouyang & Jiao (2021); Chen et al. (2020); Acosta et al. (2023); Pathiranage & Karunaratne (2022); Sangster et al. (2020); Moorhouse et al. (2023).	AI-driven formative assessments, Automated essay scoring	Shift towards continuous assessment, Increased use of project portfolios and peer assessments	Combination of online and offline assessment methods, Real-time feedback mechanisms.	Online proctoring software, AI-powered plagiarism detection tools, Digital portfolio platforms.
Curriculum Design	Roy (2020); Roschelle et al. (2020); Zhao & Watterston (2021); Grassini (2023); Carius (2021); Holmes & Tuomi (2022).	AI-assisted curriculum mapping and optimization; Adaptive learning pathways.	Integration of digital literacy and 21st-century skills; Emphasis on interdisciplinary learning.	Modular course designs for flexibility; Integration of online and offline learning experiences.	Curriculum mapping software, Learning design platforms, AI-powered content recommendation engines

Aspect	Researcher	Artificial Intelligence (AI) in Education	Post-Pandemic Pedagogical Innovations	Impact on Hybrid Education	Tools Used
Accessibility and Inclusion	Zawacki-Richter et al. (2019); Huang (2024); Acosta et al. (2023); Zhao & Watterston (2021); Khedrane (2024); Moorhouse et al. (2023).	AI-powered assistive technologies, Language translation for international students.	Universal Design for Learning (UDL) principles in online environments, Increased focus on digital equity.	Combination of synchronous and asynchronous options for diverse learner needs, Adaptive technologies for both online and in-person settings.	Screen readers and text-to-speech software, Closed captioning and transcription tools, Adaptive learning platforms

(Source: Literature Review)

1. Learning Experience

Literature highlights how intelligent tutoring systems and flexible projects and assessments have enhanced personalized learning areas (Chen et al., 2020; Ouyang & Jiao, 2021; Holmes & Tuomi, 2022). Such systems help in a student-centred approach where the students engage with customized educational content. This transition, coupled with hybrid learning methods that combine both online and offline instructions, has completely changed the students' experience with learning. AI platforms such as learning management systems (LMS), virtual reality (VR), and augmented reality (AR) applications have improved learner engagement and made learning interactive (Acosta et al., 2023; Carius, 2021; Moorhouse et al., 2023).

2. Pedagogical Approaches

Artificial intelligence has not only reshaped the teaching pedagogies but also the automated grading systems (Grassini, 2023; Mirzaeian et al., 2016). These technologies assist educators in optimizing their workflows, hence allowing for increased student participation. The use of video conferencing platforms like Zoom and AI-powered content recommendation systems has expanded the horizons for teachers (Sangster et al., 2020; Zhao & Watterston, 2021).

3. Student Support

AI chatbots provide round-the-clock assistance, addressing student inquiries. Virtual office hours, online guidance, and peer-to-peer support networks lead to student engagement. Online meetup platforms and learning analytics dashboards assist educators in keeping track of student's performance (Carius, 2021; Grassini, 2023; Narayanan et al., 2023; Huang, 2024).

4. Evaluation and Feedback

The AI-driven evaluation system has completely transformed the assessment practices (Ouyang & Jiao, 2021; Chen et al., 2020). After the pandemic, there has been a shift towards continuous and peer assessments. This methodology of assessment is the combination of both online and offline methods, supported by real-time feedback mechanisms. Even AI-powered plagiarism detection tools improve the efficacy of these evaluations in the hybrid learning environment (Acosta et al., 2023; Sangster et al., 2020).

5. Curriculum Development

AI tools assist educators in creating

adaptive learning pathways that can be modified as per the student's performance and needs. Curriculum mapping software and learning design platforms help in the creation of flexible course designs appropriate for hybrid education models (Roy, 2020; Roschelle et al., 2020; Zhao & Watterston, 2021; Carius, 2021).

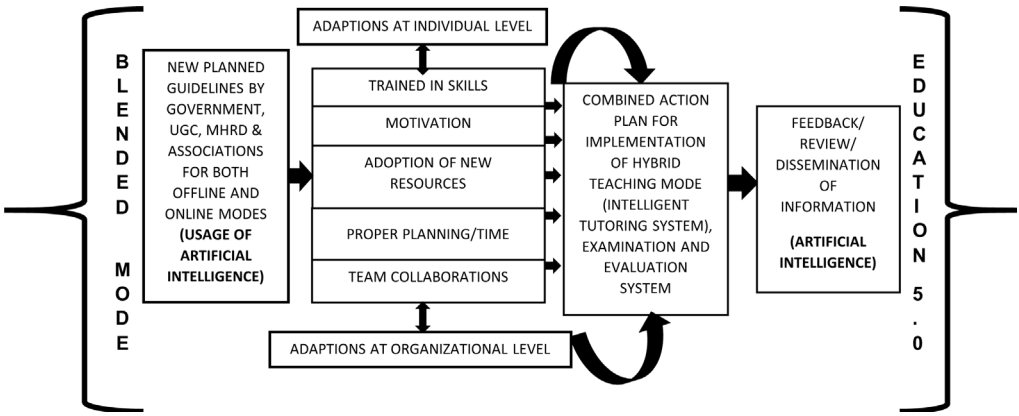
6. Accessibility in Education

The usage of AI assistive technologies has improved accessibility in education by offering language translation, screen readers, and text-to-speech functions for students with disabilities as well as international students. Post-pandemic innovations have prioritized digital equity, enabling students to have equal access to educational materials and support (Acosta et al., 2023; Khedrane, 2024; Moorhouse et al., 2023; Zawacki-Richter et al., 2019; Huang, 2024).

Findings and Discussions

Engaging the faculty as well as the students and that too a single online mode is a very difficult task but one cannot deny the fact that the introduction of the blended learning and teaching model can enhance the engagement levels of faculty as well as the students in future which also impacts the employability in one or the other way (Mandernach et al., 2015). As can be analyzed from Figure 4 below once the element of blended learning is being added in the adapted model, along with the introduction of artificial intelligence, the education model itself becomes flexible irrespective of any crisis (Kalita, 2021).

Figure-4: Education 5.0- Faculty-student engagement model with the addition of Blended learning and Artificial Intelligence


BLENDED MODE
NEW PLANNED GUIDELINES BY GOVERNMENT, UGC, MHRD & ASSOCIATIONS FOR BOTH OFFLINE AND ONLINE MODES (USAGE OF ARTIFICIAL INTELLIGENCE)
ADAPTIONS AT INDIVIDUAL LEVEL
TRAINED IN SKILLS
MOTIVATION
ADOPTION OF NEW RESOURCES
PROPER PLANNING/TIME
TEAM COLLABORATIONS
ADAPTIONS AT ORGANIZATIONAL LEVEL
COMBINED ACTION PLAN FOR IMPLEMENTATION OF HYBRID TEACHING MODE (INTELLIGENT TUTORING SYSTEM), EXAMINATION AND EVALUATION SYSTEM
FEEDBACK/ REVIEW/ DISSEMINATION OF INFORMATION (ARTIFICIAL INTELLIGENCE)
EDUCATION 5.0

(*Source: Adapted from Speck, 1996 and Mishra et al., 2020; Kalita, 2021; University Grant commission, 2021; VanLehn, 2011; Wang et al., 2023*)

Thus, the blended teaching and learning processes greatly affect the student engagement process (Sahni, 2019). A blended approach has been identified already by various academic institutions and universities in the past but has not been accepted completely in most countries yet (Lars, 2012). It can be summed up that by combining the previous education models (Speck, 1996 and Mishra et al., 2020) along with the current situation of the pandemic and looking forward to the necessity in the future the above-mentioned model has to be followed in any case to upgrade ourselves from the old methodologies of learning and engaging processes (Kalita, 2021; University Grant commission, 2021) especially in the developing nations including India.

However, its practical implementations may face several challenges such as infrastructure disparities when we compare premier institutions like IITs and IISc with rural or semi-urban institutions, faculty readiness with the latest blended teaching methods, resource allocation, cultural adaptation, logistical and technological challenges, and alignment with the new regulations.

Conclusion

Virtual classrooms and innovative online tools help to engage faculty as well as students just like a real-time classroom. Along with some challenges COVID-19 also acted as an opportunity in the education sector to explore more in the form of adoption of a hybrid education model. There is no age constraint in a learning process which may act as a hurdle, and the usage of artificial intelligence and gamification concepts in online learning may lead to a rapid developmental process. The only thing that Digital education requires is the coordination between reliable course content, faculty dedication, reliable technology, dedicated students, and, most importantly, an easily available internet connection. For many, the lockdown has resulted in an uncertain examination schedule, lost internship opportunities, and the pulling back of job offers. However, the main question of the reliability of digital platforms will always remain unsolved as everyone will agree with the fact that for a successful digital engagement, a learner or an instructor must also be honest. This reliability can be achieved by introducing a blended model of teaching and learning, which, once incorporated successfully in the Indian education sector, can do wonders by transforming the quality of the education system in India. Educators must adopt technology and pursue professional development through this Education model. Policymakers must invest in infrastructure and training and foster partnerships with tech companies to raise digital education standards. Together these strategies can create an effective and strong educational framework, transforming India's landscape and preparing the students for future challenges.

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Review Article

Multimodal Learning Analytics (MMLA) In Education – A Game Changer for Educators

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Abstract

Multimodal Learning Analytics (Hereafter MMLA) has developed as a potential educational strategy, utilising several data modalities to get deeper insights into students' learning experiences. This article thoroughly examines MMLA techniques and their use in educational settings. MMLA provides a comprehensive knowledge of learners' behaviours, interactions, and cognitive processes by combining different data sources such as video, audio, gesture, and physiological data. The article opens with a quick introduction to learning analytics and its growing importance in learning environments. It goes over how to use multimodal data, including gaze, facial expressions, body language, and activity, to get insight into student engagement and collaboration patterns. Wearable gadgets and sensors enhance MMLA by collecting physiological data and providing insights into students' emotional moods, cognitive load, and physical involvement. Moreover, the article explores the use of Kinect sensors for body language tracking. The study findings concluded on the feasibility of using MMLA through a learning analytics model for higher education. Educators can receive meaningful insights from MMLA by leveraging its power to optimise teaching practises, develop personalised learning experiences, and identify students who may require more support. Integrating different data modalities enables educators and researchers to make better-informed decisions, paving the path for a more successful and learner-centred education system.

Keywords: Multimodal learning analytics, Learning analytics, multimodal data, Microsoft Kinect

Introduction

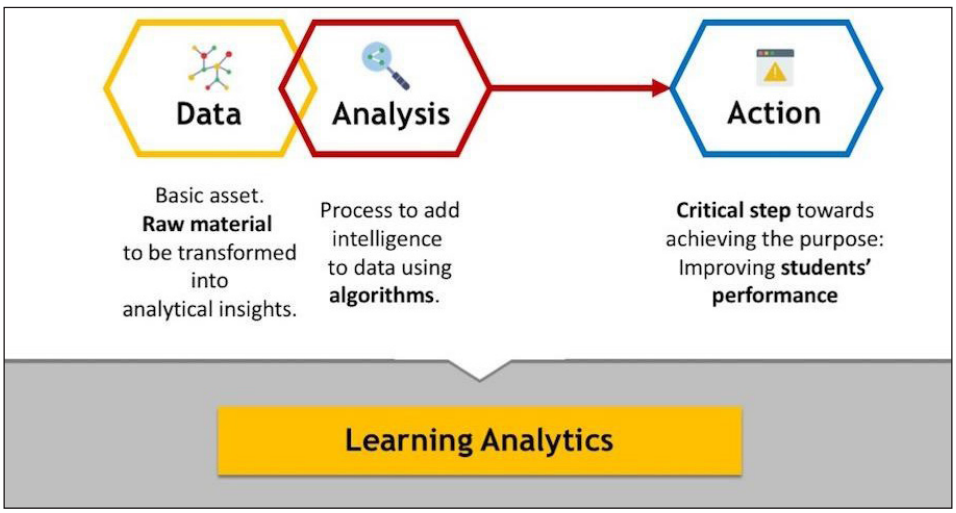
Technology has significantly impacted the way learning is assessed in classrooms. Online tests, interactive whiteboards, and educational apps have replaced conventional teaching methods. This has made it possible for teachers to evaluate their students in an engaging and effective way. Technology integration has improved assessments by making them faster, more adaptive, and more personalised. Generally speaking, technology has transformed the assessment process, giving teachers more precise insights into student learning and assisting students in realising their full potential. Teachers can use the recently popular learning analytics tools to examine student data, identify learning gaps, and alter instruction.

Learning Analytics (Hereafter LA) refers to the measurement, collection, analysis, and reporting of data about learners and their learning contexts for understanding and optimizing learning and the environment in which it occurs (Siemens & Baker, 2012). In simpler

terms, LA combines student data with intelligent analysis to improve student performance. Learning analytics seeks to comprehend and enhance learning (Ochoa & Worsley, 2016). Past learning analytics research has produced practical data-driven strategies that help educators understand and assess their efforts and innovations in designing learning activities (Lockyer & Dawson, 2012).

Most studies on learning analytics and educational data mining (EDA) have focused on cognitive tutors and online courses. These systems are highly structured and can only be used through interactions that take place on a computer (Perveen, 2018). Cognitive tutors are computer programs that offer personalized guidance to students based on their progress (Guo et al., 2021), while educational data mining refers to analysing educational data to understand learning patterns (Alvarez-Garcia et al., 2024; Sarker et al., 2024). Since many institutions of higher learning use LA, it has been regarded as an emerging field of study that merits more investigation (Guzmán-Valenzuela et al., 2021). Research studies have shown that online learners who frequently interacted with the learning analytics dashboard demonstrated greater academic performance (Kokoç & Kara, 2021). Learning Analytics can transform how we support learning processes, enhancing learning practises and leading to a deeper understanding of students' learning experiences (Viberg et al., 2018). Figure 1 shows the basic architecture of the learning analytics process.

Figure-1: Basic architecture of a Learning Analytics process (Corner, 2022).



Academic achievement, student engagement, and behavioural data are just a few of the data types that LA uses to pinpoint learning patterns, monitor student progress, and direct instructional decisions. By incorporating information from various sources, such as text, images, audio, and video, multimodal learning analytics broadens the possibility of this idea. Multimodal learning analytics (MMLA), as a new trend in learning analytics, leverages advances in multimodal data (e.g., speech, eye gaze, heart rate, and body movement data) to capture and mine learning processes and to address the challenges of investigating multiple, complex learning-relevant

constructs in learning scenarios (Xu et al., 2023b). MMLA may be defined as a set of techniques employing multiple sources of data (video, logs, text, artefacts, audio, gestures, biosensors) to examine learning in realistic, ecologically valid, social, mixed-media learning environments (Mangaroska et al., 2020). The main goal of multimodal learning analytics (MMLA) is to combine these various sources of learning traces into a single analysis (Ochoa, 2017). MMLA is a subdomain that aims to integrate various learning traces into LA research and practice by emphasising understanding and optimising learning in digital and real-life circumstances where actions are not always facilitated over a computer or digital device. In MMLA, learning evidence is gathered from various sources, including log files, electronic documents, audio and video recordings, pen movements, position tracking apparatus, biosensors, and other modalities useful for analysing or measuring learning. A more complete picture of the learner's actions and internal state is presented by combining various modalities (Blikstein, 2013).

This paper discusses the theoretical aspects of Learning Analytics, its contributing factors, Multimodal Learning Analytics, and the modalities and their application in education.

Background

Learning Analytics (LA)

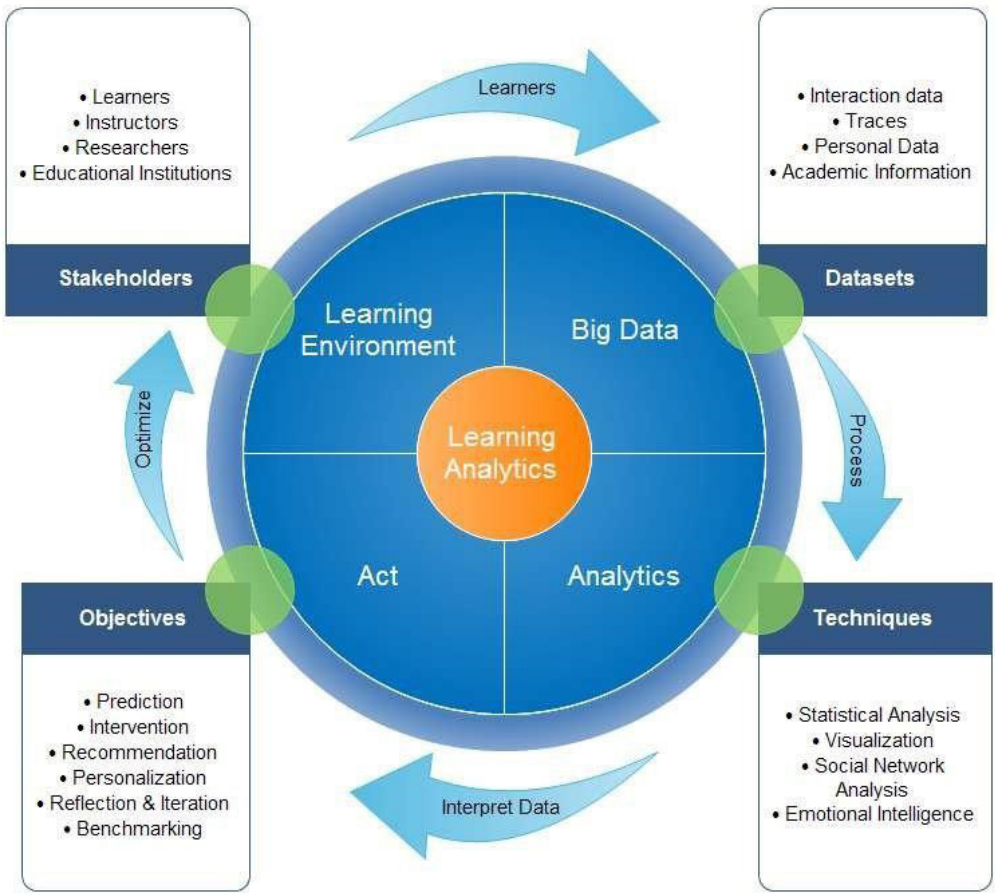
People have studied the teaching and learning processes for a very long time, kept track of pupil outcomes, looked over educational or professional data, made assessments, and used data to strengthen teaching and learning. Building on these well-established fields, learning analytics uses computational analysis methods from data science and artificial intelligence (AI) to take advantage of the fresh possibilities presented by the collection of new types of digital data from students' learning activities. Learning Analytics is the measurement, collection, analysis and reporting of data about learners and their contexts, for purposes of understanding and optimising learning and the environments in which it occurs (What Is Learning Analytics? - Society for Learning Analytics Research (SoLAR), n.d.). This broad definition of learning analytics was developed at the inaugural global meeting on Learning Analytics and knowledge (LAK'11) of the Society for Learning Analytics and Research (SoLAR).

Learning analytics employs data analysis techniques to comprehend students' performance, engagement, and learning habits. Then, decisions are made with these insights in mind and educational practices are enhanced. The whole process is typically illustrated using Clow's (2013) learning analytic cycle: understanding learning and learners, collecting data, defining metrics, and deriving interventions aimed to optimizing the educational processes (Nistor & Hernández-Garcíac, 2018). Let's see how a traditional LA operate in a university context.

A university, for instance, wants to raise student retention rates and pinpoint the elements that influence student achievement. They implement learning analytics by gathering information from various sources, such as student grades, course attendance, online interactions, and library usage. The university learns from data analysis that students who regularly attend classes, participate in online discussions, and use library resources typically have better grades and higher retention rates. They also discover a link between lower overall student performance and courses with low student satisfaction ratings. The university makes several decisions in light of these revelations. They start by implementing targeted interventions,

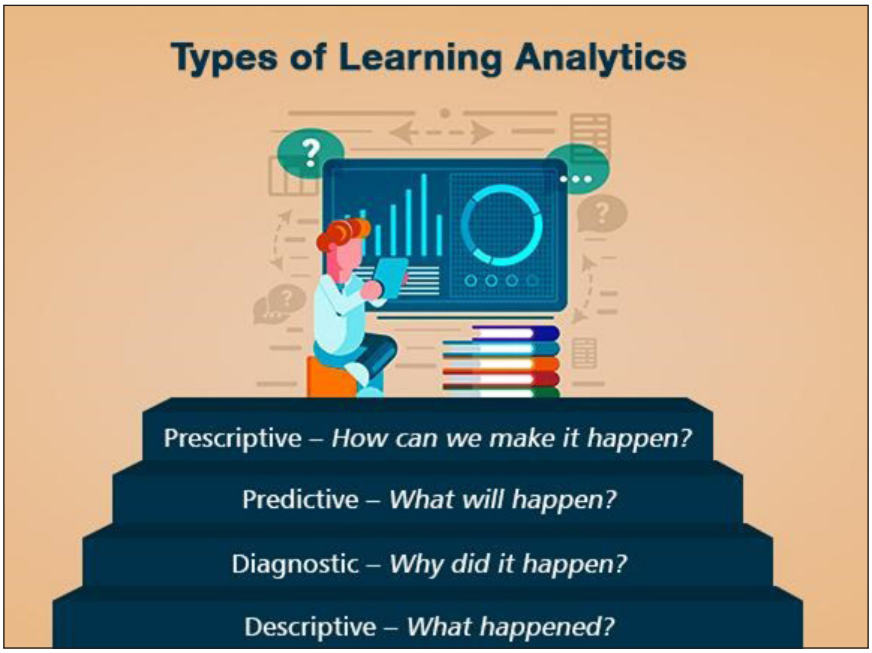
like sending tailored notifications to students who frequently miss class, giving struggling students extra support, and enticing students to participate in online discussions. These interventions are designed to boost student engagement, attendance, and learning outcomes. Second, the university reviews the teaching strategies and curriculum for the courses with low student satisfaction. To increase student engagement and satisfaction, they take feedback from the students into account, alter the course material, and add more interactive learning activities. The university can identify trends and patterns in student behaviour and performance using learning analytics. This enables them to take proactive measures, tailor the educational experience, and make decisions based on the best information available to increase student success and the calibre of education. A summary of the above example is illustrated in Figure 2.

Figure-2: Learning Analytics Cycle (Khalil, M; Ebner, 2015)



In order to understand the past, present, future, and potential outcomes, LA employs the methodologies of descriptive analytics, diagnostic analytics, predictive analytics, and prescriptive analytics (Figure 3).

Figure-3: Types of Learning Analytics (Athmika, 2019)


Types of Learning Analytics
Prescriptive – How can we make it happen?
Predictive – What will happen?
Diagnostic – Why did it happen?
Descriptive – What happened?

There are numerous benefits of having LA in education, like identifying target courses, curriculum improvement, determining student learning outcomes and keys for improvement, as well as personalised learning. The main issue with using LA is that it only processes traditional data like log files and click stream data, where the computer is a key component in the process. As learning is not exclusively a computer-mediated process, analysis of these unimodal data will not give a complete picture of the learning trajectory. However, this gap is filled by taking multiple data modalities into consideration. Thus, the infusion of different types of modalities in LA research gave rise to a new dimension called Multimodal Learning Analytics (MMLA). Before examining the specifics of what MMLA entails, let's take a broad look at multimodal data and the ways these are collected. In order to address the prospective growth of this emerging discipline, the following research questions were deeply studied to come up with certain valid conclusions in this area.

Research Questions

The thematic research on Learning Analytics tries to address the following research questions

1. What are the different factors contributing to developing the construct learning analytics theoretically?
2. How does learning analytics utilize the different modalities of data for predicting learner performance?

Method

This review adopts a systematic approach to identify and synthesize the theories that contribute to the development of learning analytics, focusing on how different modes of data collection can be leveraged to optimise learning outcomes. By systematically analysing the literature, this review highlights the theoretical underpinnings that have shaped learning analytics research, particularly in multimodal learning analytics (MMLA). The primary objective

is to explore the contributing factors that help develop domain learning analytics. The paper then addresses the role of learning analytics in utilising the different modalities of data and how multimodal learning analytics applies to learning environments.

The review emphasizes theoretical contributions and frameworks from prior research to better understand the evolution of learning analytics as a field, particularly how data-driven insights have been applied to enhance personalized learning and improve educational outcomes.

Data Sources and Search Strategy

To ensure a comprehensive understanding of the theoretical aspects of learning analytics, a systematic search was conducted across two major academic databases: Scopus and Google Scholar. These databases were chosen due to their extensive multidisciplinary research coverage and relevance to educational technology and analytics studies. The search was limited to peer-reviewed journal articles and conference papers published between 2010 and 2022 to capture the field's most relevant advancements and theoretical developments during this period.

A broad range of keywords and search terms were employed to encompass various aspects of learning analytics, including the use of multimodal data. The key search terms used were: "Multimodal learning analytics", "K-12 classrooms", "Learning analytics tools", "Data collection methods in learning analytics", "Educational data mining", and "Theoretical models in learning analytics". These terms were combined using Boolean operators (AND, OR) to refine the search results and ensure coverage of different perspectives and approaches to learning analytics. For example, "multimodal learning analytics" AND "K-12 classrooms" was used to specifically target studies related to the K-12 educational context, while "learning analytics tools" OR "educational data mining" was used to broaden the scope of tools and methods used to collect and analyse student data. The search strategy ensured that both specific and general learning analytics models were captured to provide a holistic view of the theoretical landscape.

Inclusion and Exclusion Criteria

The inclusion and exclusion criteria were applied to filter relevant studies for the review. Studies were selected based on the following:

Inclusion Criteria

1. Studies focused on theoretical or conceptual development in learning analytics or multimodal learning analytics.
2. Peer-reviewed journal articles and conference papers published between 2010 and 2022.
3. Research that addressed the use of learning analytics in K-12 classrooms.
4. Articles that discussed various modes of data collection (e.g., gaze, body language, facial expression, etc.) and their application in optimizing learning outcomes.
5. Studies that included models, frameworks, or theories relevant to learning analytics or data integration.

Exclusion Criteria

1. Articles not directly addressing theoretical aspects of learning analytics.
2. Studies focusing exclusively on higher education or adult learning environments unrelated to K-12 settings.

3. Non-peer-reviewed sources, including reports, book chapters, or editorials.
4. Papers that did not provide substantial contributions to the development of theoretical constructs in learning analytics.

A systematic search was conducted across multiple academic databases, including Scopus and Google Scholar. The search was limited to journal articles and conference papers published between 2010 and 2022. Keywords and search terms such as "multimodal learning analytics, K-12 classrooms, learning analytics tools" were combined with Boolean operators (from the Scopus database) to capture a broad range of relevant studies.

Data Synthesis and Analysis

A narrative synthesis approach was adopted to integrate the findings of the selected studies. The focus was on identifying recurring theoretical themes, such as how learning analytics frameworks have evolved to incorporate multimodal data and how these developments have impacted learning outcomes. Studies were grouped based on the following themes:

1. Theoretical models of learning analytics.
2. The role of different data types (gaze, body language, facial expression) in enhancing learning outcomes.
3. Theoretical frameworks that support integrating learning analytics tools in K-12 classrooms.

Where applicable, the review highlights how including multimodal data has contributed to more personalized and adaptive learning experiences, particularly through continuously monitoring students' learning processes.

Development of Learning Analytics: Contributing Factors

Due to the growing accessibility of enormous databases of student learning data, LA can be extensively used to track and analyse student learning in greater detail and depth than ever before. Following the pandemic, there has also been a worldwide rise in interest in individualised learning. The emergence of novel educational technologies like Learning Management Systems (LMS) and Virtual Learning Environments (VLEs) have widened the avenues for data collection through Learning Analytics. Besides, the following are five distinctive areas depicted by the 'Learning Analytics in Higher Education Adoption Model' that have contributed to the theoretical framework of LA in higher education (Lester et al., 2017a).

1. Organizational Theory
2. Technology Alignment and Adoption
3. Faculty/Advisor Beliefs and Behaviours
4. Student Use and Action
5. Ethics and Privacy

Organizational Theory

Learning Analytics is a juncture where man and machines intersect, so a good structure in the organization is required. Even though LA can do wonders in the educational field, organizations do face some difficulties in adopting this latest technology. These hurdles include a lack of interest, time, money, training, incentives etc. (Lester et al., 2017). Organizational theory in the LA context

suggests the significance of having good institutional preparation and an institutional commitment.

Technology Alignment and Adoption

The most popular technology adoption models that are relevant to LA are the Technology Adoption Model (TAM) (Venkatesh & Davis, 2000) and the Unified Theory of Acceptance and Use of Technology (UTAUT). According to the UTAUT (Venkatesh et al., 2003) theoretical model, behavioural intention influences how technology is actually used. The direct impact of four main constructs, including performance expectancy, effort expectancy, social influence, and facilitating conditions, determines the anticipated likelihood of adopting the technology. Age, gender, experience, and voluntariness of use all act as moderators of the influence of predictors (Lester et al., 2017b; Venkatesh et al., 2003). Though educational institutions strive to get higher ranks through improved academic outcomes for their students, they are less enthusiastic about imbibing this latest technology. The sooner the institutions align with LA, the better the outcomes.

Faculty/Advisor Beliefs and Behaviours

Today, LA allows teachers to effectively scaffold and support students' digital learning. For that, teachers must be highly proficient in digital technology and have mastered the communication, cooperation, creativity, and problem-solving abilities necessary for 21st-century learning to succeed. However, teachers need help understanding the linked digital pedagogical practises and subject-matter expertise and how the technological components might be utilised to promote learning (Sheffield et al., 2018). Therefore, education professionals' decisions to incorporate novel practises, like LA, into their pedagogical practises are heavily influenced by their professional beliefs and the behaviours that go along with them (Lester et al., 2017a).

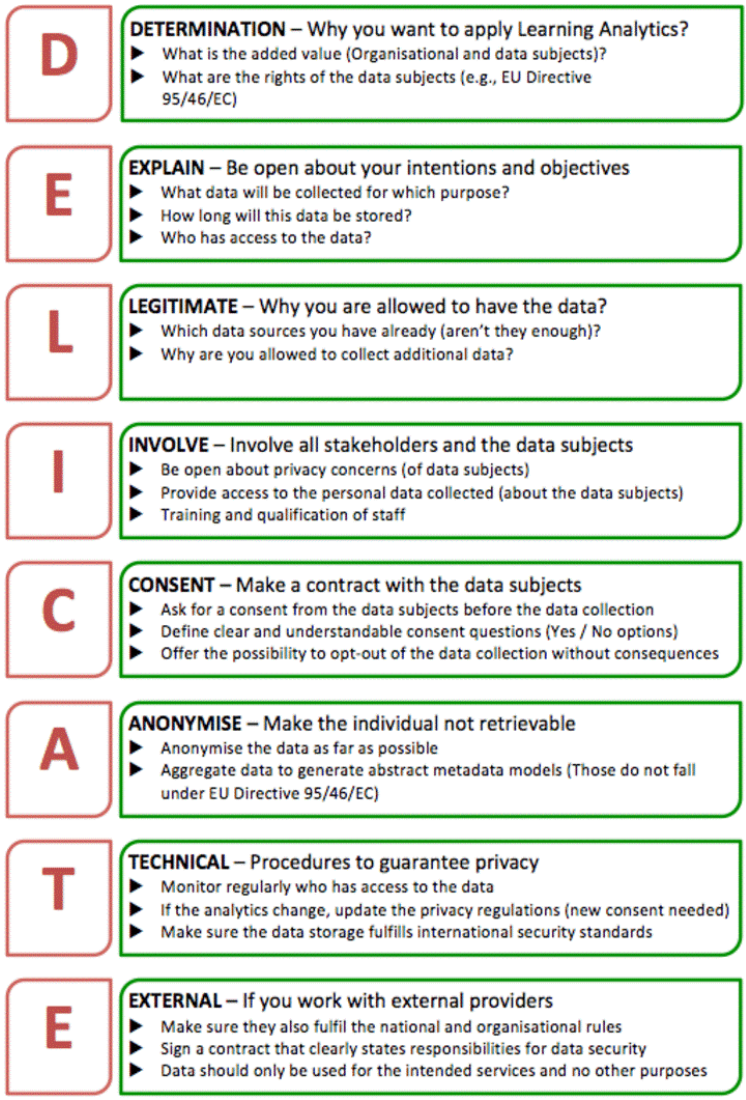
Student Use and Action

The major beneficiaries of any teaching-learning process are the learners. Though LA tools greatly help instructors, the major advantage is what they offer to students. LA provides learners with real-time feedback while interacting with a personalized learning dashboard (Arnold & Pistilli, 2012). This helps students understand their learning progress comprehensively (Lester et al., 2017b).

Ethics and Privacy

Following worries from governments, stakeholders, and civil rights organisations about privacy and the ethics involved in the handling of personal data, the widespread adoption of Learning Analytics (LA) and Educational Data Mining (EDM) has recently slowed down and, in some notable cases, even been reversed (Drachsler & Greller, 2016). The Learning Analytics Community Exchange (LACE) has developed an 8-item checklist named as DELICATE checklist that operationalizes essential ideas and inquiries for privacy and ethics in learning analytics (Ferguson et al., 2016). The DELICATE checklist assists in identifying potential barriers to the adoption of learning analytics and the implementation of reliable learning analytics for higher education (see Figure 4).

Figure-4: DELICATE checklist for Trusted Learning Analytics (Drachsler & Greller, 2016)


D
DETERMINATION – Why you want to apply Learning Analytics?
What is the added value (Organisational and data subjects)?
What are the rights of the data subjects (e.g., EU Directive 95/46/EC)
E
EXPLAIN – Be open about your intentions and objectives
What data will be collected for which purpose?
How long will this data be stored?
Who has access to the data?
L
LEGITIMATE – Why you are allowed to have the data?
Which data sources you have already (aren't they enough)?
Why are you allowed to collect additional data?
I
INVOLVE – Involve all stakeholders and the data subjects
Be open about privacy concerns (of data subjects)
Provide access to the personal data collected (about the data subjects)
Training and qualification of staff
C
CONSENT – Make a contract with the data subjects
Ask for a consent from the data subjects before the data collection
Define clear and understandable consent questions (Yes / No options)
Offer the possibility to opt-out of the data collection without consequences
A
ANONYMISE – Make the individual not retrievable
Anonymise the data as far as possible
Aggregate data to generate abstract metadata models (Those do not fall under EU Directive 95/46/EC)
T
TECHNICAL – Procedures to guarantee privacy
Monitor regularly who has access to the data
If the analytics change, update the privacy regulations (new consent needed)
Make sure the data storage fulfills international security standards
E
EXTERNAL – If you work with external providers
Make sure they also fulfil the national and organisational rules
Sign a contract that clearly states responsibilities for data security
Data should only be used for the intended services and no other purposes

Multimodal Data

Traditional learning analytics typically use unidimensional data (Schwendimann et al., 2017), out of which most learning management systems utilising click stream data have their own limitations. Real learning is complex, so the learner's behaviour, cognition, and learning contexts are equally important. Digital data, physical data, physiological data, psychometric data, and environment data are the categories under which the data in MMLA fall (Mu et al., 2020). For instance, audio, video, electrodermal activity data, eye-tracking, user logs, and click-stream data are typical examples of such multimodal data (Blikstein & Worsley, 2016). Following are some of the different modes of data that are relevant for learning, though the list is incomplete.

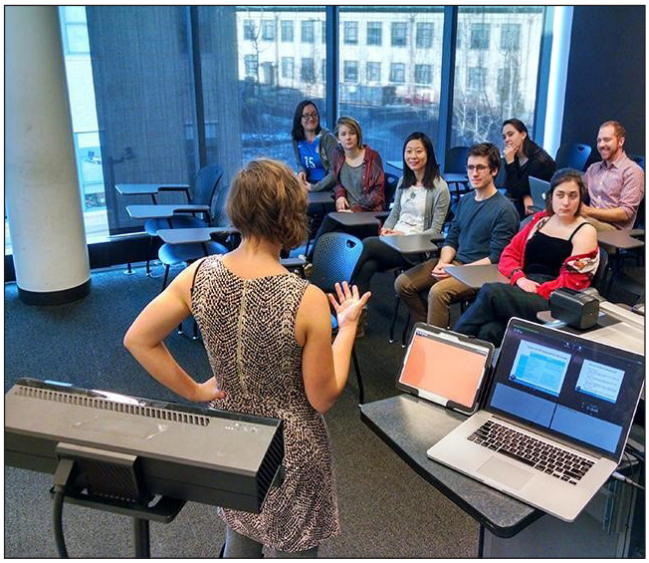
Gaze

Gaze means to look at something steadily and intently, especially something that

arouses curiosity and attention, which is a necessary component of learning. The attention level can be assessed using an eye tracker, just like a teacher assessing the students during a demonstration or a lecture. The main methods for recording gaze are monitor-mounted eye-trackers and special eye-tracking glasses, which are invasive and too expensive to be extensively used in educational settings. Past research used video recordings for gaze capturing in MMLA (Raca & Dillenbourg, 2013). They created a multi-camera system to record teacher actions and student reactions during class. A portable eye tracker worn by the instructor, a quantitative feedback form, and detailed conversations with students about how the lessons they took and their participation affected them were used to supplement the data. A camera, or a collection of cameras, was assigned to record the subject(s)' head and eyes. The gaze direction information is extracted from the video recording using computer vision techniques. Recently, online gaze recording software has made tasks much easier and more economical in terms of cost.

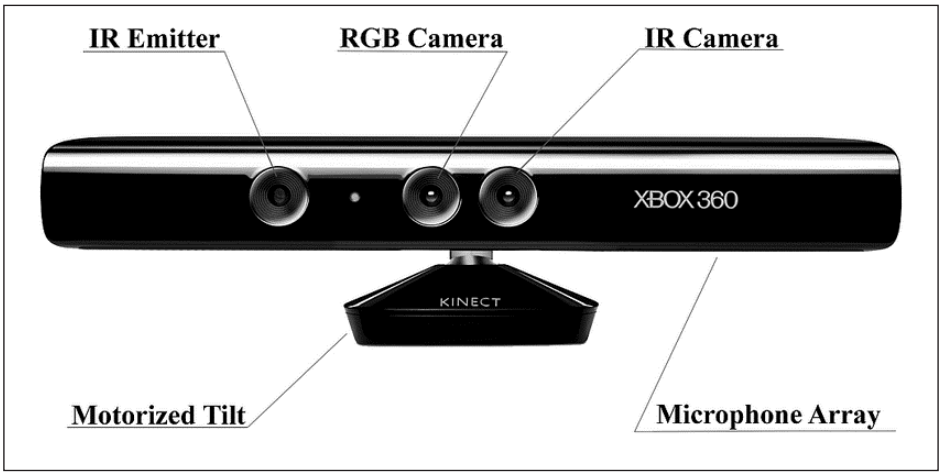
Body Language (Gesture, posture and body movements)

Figure-5: Tracking body language using a sensor



In an educational setting, body language is the non-verbal form of communication that involves gestures, posture, body movements, physical clues, etc., between a learner and the learning material, between the learners, and between the learner and the teacher. Figure 5 shows the tracking of students' body language in a classroom. Because of the reasonable ease of taking video in real-life surroundings, as well as the accessibility of affordable 2-D and 3-D sensors and efficient computer vision algorithms for feature mining, posture, gesticulations, and motion, have been the modes most frequently studied in MMLA (figure 2). The most common device used for automatic extraction of human motion is the Microsoft Kinect (Zhang, 2012). Through a mixture of video and depth capture, Kinect (figure 6) can provide researchers with a reconstructed skeleton of the subject for each captured frame, which is ideal for capturing body postures and gestures ("Handbook of Learning Analytics," 2017). Newer versions of the Kinect sensor can also extract hand gestures (Andres Vasquez et al., 2015).

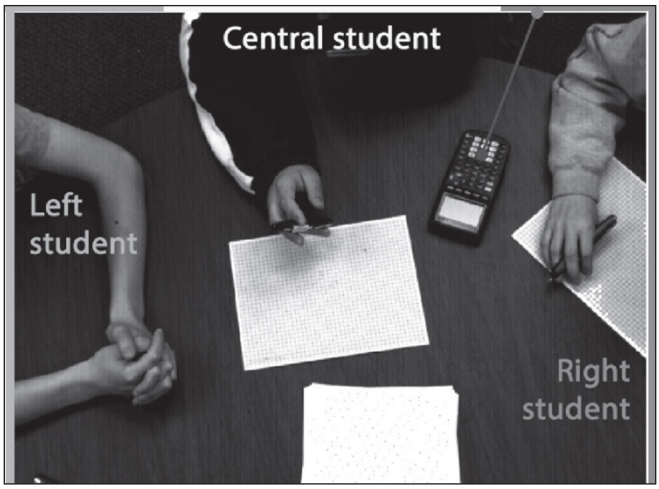
Figure-6: Microsoft Kinect device and its sensors



Action

The primary application of action footage and investigation in MMLA is expertise assessment. For example, the analysis of hand and wrist movement can determine the level of expertise in an engineering building activity (Blikstein, 2014). The percentage of time a learner uses a calculator when solving mathematical problems can be measured (Ochoa et al., 2013). In problem-solving sessions, (Ochoa et al., 2013) tracked the position and angle of the calculator (Figure 7). The student using the calculator at that specific frame in the video was then inferred from the position and angle of the calculator ("Handbook of Learning Analytics," 2017).

Figure-7: Determination of calculator use for expertise estimation (Ochoa et al., 2013)



Facial expression

Facial expressions are also a form of nonverbal communication that conveys a learner's immediate thoughts and emotions about a learning experience. In an educational environment, facial expression tracking is the process of capturing and analysing students' facial expressions during learning activities

to acquire insights into their emotional states, engagement levels, and cognitive processes. In this context, facial expression tracking entails detecting and analysing student facial movements, muscle contractions, and expressions using technology such as cameras or specialised facial recognition software. These technologies can recognise a variety of facial expressions, such as happiness, sadness, surprise, rage, and others.

Multimodal Learning Analytics tries to identify how students respond to learning materials, interactions with classmates, or instructional tactics by tracking facial expressions. It can reveal important information regarding students' emotional engagement, degrees of interest or boredom, and potential sources of confusion or frustration. Data from facial expression monitoring can be integrated with other modalities, such as audio analysis, gaze tracking, or interaction patterns, to provide a more complete understanding of students' learning experiences. Tracking facial expressions using a video camera is the most economical way of doing it in a real classroom.

Multimodal Learning Analytics (MMLA) In Education

By its very nature, learning is frequently multimodal. Learning can be achieved through any form of interaction between people where considerably complicated data can be encoded, including studying a text, attending a lecture, observing an event via electronic or physical tools, and other modes of human interaction ("Handbook of Learning Analytics," 2017). A student gesticulating in agreement when a teacher asks if the lesson has been grasped or the instructor highlighting a point during an explanation are just two examples of feedback loops that are used in the learning process. Although they typically encode less complex information, these feedback modes are crucial to the process. Traces of interactions occurring in each relevant mode should be obtained if learning is to be analysed, understood, and optimised (Ochoa, 2017).

Multimodal learning analytics (MMLA), as a new trend in learning analytics, leverages advances in multimodal data (e.g., speech, eye gaze, heart rate, body movement data) to capture and mining learning processes and address the challenges of investigating multiple, complex learning-relevant constructs in learning scenarios (Xu et al., 2023a). MMLA may be defined as a set of techniques employing multiple sources of data (video, logs, text, artefacts, audio, gestures, gaze, biosensors) to examine learning in realistic, ecologically valid, social, mixed-media learning environments (Mangaroska et al., 2020; Ochoa, 2017). It emphasizes extracting these data from various modes of communication, irrespective of the medium on which they are encoded or recorded (Ochoa, 2017).

A promising method has been described as the combination of physiological information from the central nervous system (e.g., electroencephalography, or EEG) and external behaviours (e.g., eye movements) (Zheng et al., 2019). Recent research has demonstrated that combining multimodal data streams significantly improves accuracy and yields more user experience insights (Zheng et al., 2019). For context-aware environments, for instance, brain and eye movement signals convey significant information about users' social and emotional information (Lee & Anderson, 2017). So, one research challenge is to use data-driven insights and multimodal user data to design skills that back human learning. Whether an action is finished, the user creates rich information frequently overlooked when developing learning-supporting

technologies (e.g., facial expression, eye movement, and brain activity). The term 'multimodality' might have been used since learners use various approaches to construct their knowledge.

Multimodal Learning Analytics can be used to realize how successfully learners practice the prospects aimed at learning. Multimodal data from wearables and online courses, on the one hand, enables more precise statements about the specific learning scenario, and, on the other, it increases students' personal perceptions of emotional states (Andrade et al., 2016), their perception of stress, and their sense of well-being or energy (Ciolacu & Svasta, 2021). This method offers educators more opportunities for individualised instruction and student support while enabling a more thorough understanding of student learning. Integrating learning analytics and multimodal learning analytics can revolutionise education by enabling teachers to make data-based decisions and improve student learning outcomes.

MMLA emphasises group projects, hands-on activities, and face-to-face interactions while downplaying the computer screen as the primary object of the interface. Though the role of computers cannot be completely removed, the advantage of having compact, innovative computational devices like wearables, microcomputers, etc., is that they may be easily integrated with any complex learning environment.

Results & Discussion

In this paper we have identified certain contributing factors for the theoretical development of Learning Analytics in higher education. They are Organizational Theory, Technology Alignment and Adoption, Faculty/ Advisor Beliefs and Behaviours, Student Use and action, Ethics and privacy. This is on par with what Lester et al. (2017a) have described as the main areas of LA in the higher education model. Apart from the aforesaid technical components, Ethics and Privacy should also be given due concern while dealing with student data. Drachsler & Greller (2016). The second research question was to analyse how learning analytics utilizes the different modalities of data for predicting learner performance. The use of multimodal data, including gaze, facial expressions, body language, and activity, can give insight into student engagement and collaboration patterns. Blikstein and Worsley (2016) list audio, video, electrodermal activity data, eye-tracking, user logs, and click-stream data as typical examples of multimodal data. Wearable gadgets and sensors enhance MMLA by collecting physiological data and providing insights into students' emotional moods, cognitive load, and physical involvement.

Conclusion

At present, Multimodal Learning Analytics is the most modern and potential form of Learning Analytics because it allows for the analysis of natural means of learning and interaction patterns during learning activities that are individual-based or group-based. It utilises all available sources for data (motion, conversation, gestures, writing, online logs, etc.) for enhanced comprehension of the learning process, offline or online. The introduction of sensors allows for the micro-level refinement of the physical data collected, like the angle of head movement and finger movement on the display. Educators and researchers can use this multimodal method to investigate the relationships between facial expressions and various learning outcomes, instructional tactics, or pedagogical interventions. It has the potential to assist educators in improved understanding of pupils' learning pathways as well as cognitive

functioning, even in compound and open-ended educational settings. Multimodal Learning Analytics data can inform instructional decision-making, allowing educators to alter their teaching strategies, provide personalised feedback, or identify students needing further support. Meanwhile, when tracking various data in educational contexts, it is critical to keep ethical factors such as student privacy and informed consent in mind.

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Review article

Recent Trends of Online Degrees in India: A Student's Perspective

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Abstract

Online degree programs are undeniably expanding the horizons of knowledge dissemination by providing education without constraints related to age, gender, educational background, or socioeconomic status. In April 2022, the University Grants Commission issued guidelines that permit dual degree and joint degree programs, as well as the initiation of fully online degree programs by accredited Higher Education Institutions. This move has opened up avenues for students to pursue either exclusively online degrees or a combination of online and traditional courses. While existing research has delved into the perspectives of teachers, administrators, and employers regarding online education delivery, there has been a notable gap in understanding the experiences and viewpoints of students. This research analyzed students' experiences, perceptions, challenges, newfound opportunities, and overall opinions regarding online degree programs through a qualitative survey. It conducted a comparative assessment of the viewpoints of students enrolled in online and/or traditional educational programs and critically examined students' perspectives statistically. The overall consensus among students regarding the reliability and future of online degree courses was notably positive. The findings from this study can be leveraged to improve instructional methods and enhance the accessibility and quality of education delivery.

Keywords: Online Degree, Traditional Degree, Dual Degree, Online Education, Online Higher Education, Student's Perspective

Introduction

Online degree programs are gaining significant traction on a global scale. The COVID-19 pandemic played a pivotal role in reshaping the education landscape by necessitating a shift from traditional classroom settings to online platforms. This transformation underscored that virtually anyone with a smart device and internet access can engage with various forms of education through online channels. The Indian government has introduced several initiatives to encourage online education, including programs like PM e-Vidya (2024), which will benefit nearly 25 crore school-going children across the country, Pradhan Mantri Gramin Digital Saksharta Abhiyan, the establishment of the National Education Technology Forum (2024) and the opening of National Digital University (2022).

According to the IAMAI-Kantar ICUBE Report (2022), 52 per cent of the Indian population, equivalent to 759 million individuals, including 399 million from rural areas and 360 million urban dwellers, have embraced active internet usage, and this figure is expected to reach 900 million by 2025. This report highlights the pivotal role of rural India in propelling the country's internet expansion. Internet expansion may significantly increase the accessibility of

education where several individuals are unable to pursue secondary or higher education due to a range of factors such as financial limitations, family responsibilities, personal circumstances, inadequate study resources, limited institutional access, etc.

The rise of online education has been supported by UGC initiatives, including recognizing Swayam credits (Abhiraj P, 2022) and urging institutions to offer comprehensive online courses. This has significantly broadened the availability of online learning, meeting the educational needs of India. Platforms like iLearn, Swayam, NPTEL, UpGrad, and FutureLearn, along with institutions like Aligarh Muslim University, Jamia Millia Islamia, Amity University, Anna University, Jawaharlal Nehru University, IITs, and IIMs, now offer diverse online degree programs in fields like data science, programming, artificial intelligence, digital marketing, and communication skills. UGC affirms that degrees obtained through online modes are considered equivalent to those earned through traditional in-person methods (Times of India, 2022). The UGC has issued guidelines encouraging students to consider online learning programs. Franchising for online programs is prohibited, and students are advised to check the recognition status of higher educational institutions (HEIs) and follow the academic session duration, qualification requirements, and nomenclature as per UGC notifications. Popular online courses include MBA, Data Science, BCA, BBA, B.Com, MA, BSc, and PGDM and programs like M.Phil and Ph.D. are not permitted online (Chanda, 2022).

Data from Distance Education Bureau (University Grants Commission, 2023) of India indicates a consistent rise in the number of institutions participating in online learning, reflecting the sector's increased emphasis on remote education due to the digital transformation accelerated by the COVID-19 pandemic. By 2022, over 72,000 students enrolled in 371 online programs from 66 accredited institutions, marking a 179 per cent increase compared to previous years.

Figure-1: Trend of online degree programs from the year 2021-2025

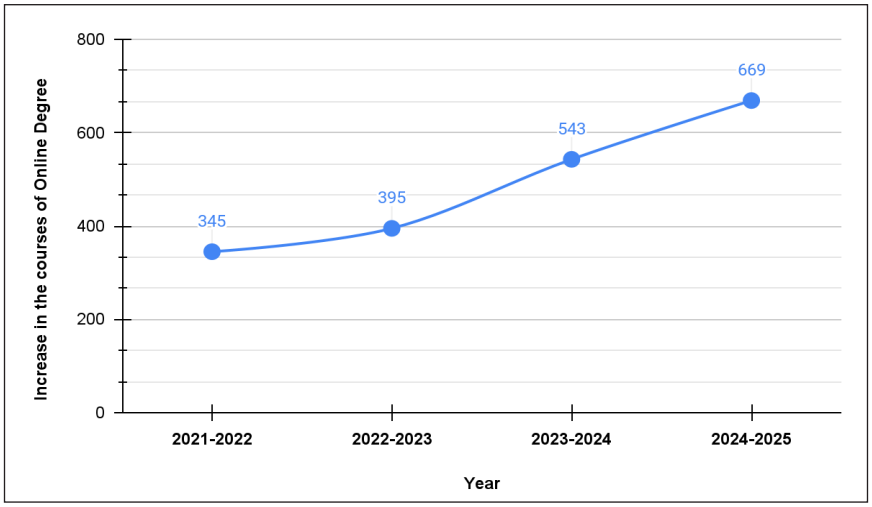


Figure 1 illustrates a consistent upward trajectory in the provision of online degree programs from 2021 to 2025 by a diverse range of institutions, including central, state, public, and private universities. In the academic year 2021-2022, the total count of online courses stood at a modest 345, rising to a

noteworthy surge of 543 new courses in 2023-2024 and 669 in academic year 2024-2025 (University Grants Commission, 2023). This data clearly demonstrates a definitive and ongoing expansion in the availability of online educational offerings, reflecting both the dynamic nature of higher education and the increasing importance and relevance of online learning options. The digital transformation of education is evidently a driving force behind this expansion, as institutions strive to meet the evolving needs and preferences of a diverse, geographically dispersed student population. Figure 2 further illustrates this trend by displaying the number of universities and institutions offering online degree courses across different Indian states in 2024.

Figure-2: State-wise Density of Universities Providing Online Degrees

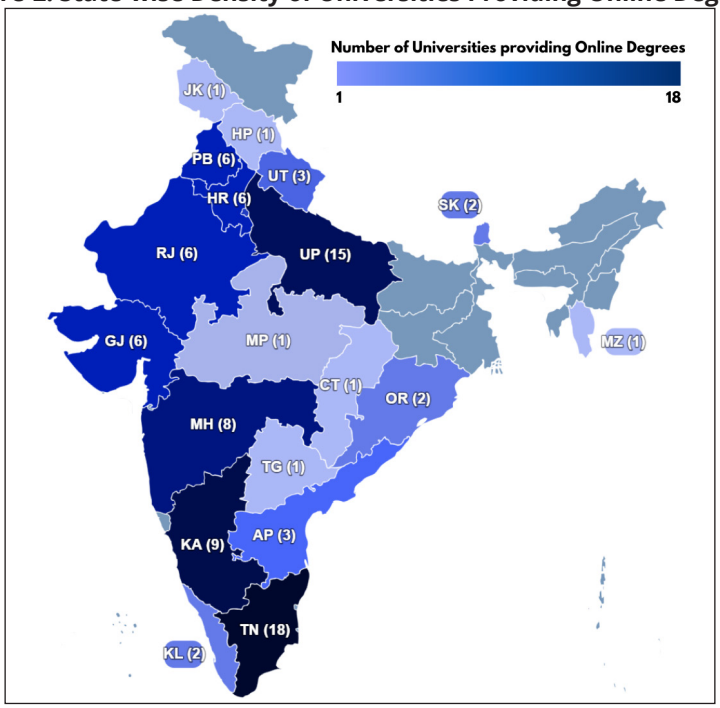
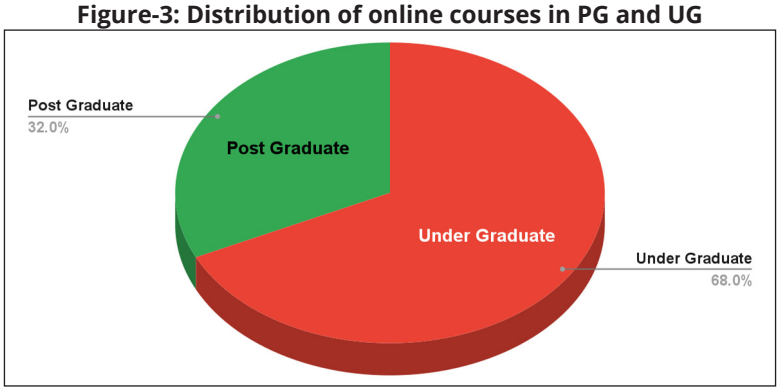


Figure 3 displays the distribution of online courses. 32 per cent of the courses fall under the category of online postgraduate (PG) programs, while the remaining 68 per cent are dedicated to online undergraduate (UG) courses.

Figure-3: Distribution of online courses in PG and UG



Background

Online degree programs are popular because of their unbiased structure. They offer flexibility in pace, are cost-effective, and remove age, social, geographical and migration constraints (Yang, Y., & Cornelius, L. F, 2004). They offer quality education, promote collaboration, connect globally, and are affordable and accessible.. The curriculum is continuously updated to align with the latest trends and global standards.

Several universities are luring students to pursue online programs by providing incentives and scholarships. For example, IGNOU (2023) is providing a 20 per cent reduction in tuition fees for all online degree programs, while Mumbai University (2024) is granting a 50 per cent scholarship to students from low-income backgrounds who choose to pursue online degree programs. Life challenges often interrupt education, leading to untimely breaks in learning for a significant portion of the population. Online education's flexibility allows remote degree pursuit, attracting students as well as full-time employees. It offers a chance to catch up on lost time, upgrade skills, enhance knowledge and achieve ambitions (Appana, 2008).

Online degrees are gaining greater acceptance among employers also. Employers increasingly acknowledge that online degrees hold the same rigour and value as traditional degrees. An example of this shift is Infosys (2024), India's second-largest IT company, which has officially stated that it will recognize online degrees from universities approved by the UGC .

Despite the growing popularity of online degree programs, there are widespread misconceptions surrounding them. According to Jonathan Adams (2008), certain obstacles, like the absence of face-to-face classroom experiences, concerns about the reputation of institutions in terms of academic rigour, and the perceived lack of mentored learning experiences, prevent online degrees from being perceived as equivalent to traditional degrees.

Literature Review

Several researchers have provided insights into stakeholder perspectives on online degree programs. According to Calvin D. Fogle and Devonda Elliot (2013), many employers find traditional or hybrid education modes more credible than purely online ones, believing offline classrooms better foster confidence, skill development, and effective learning. Vukelic, B., & Pogarcic, I. (2011) found that 90 per cent of employers they interviewed, view online degrees as lacking sufficient verification of knowledge and skills, often valuing traditional degrees more and believing online graduates may face challenges securing higher salary packages. According to Raj (2010), a traditional degree holds more value than an online degree. Concerns about frequent trivial preference for online modality question the acceptability and reliability of online degree courses (DeFleur, M. H., & Adams, J., 2004).

Bharath et al., (2022) found online learning to be as effective as traditional methods, though internet connectivity issues hindered its usage. The study suggests integrating online methods to promote future blended learning approaches. Joshi and Kantola (2022) examined teachers' views on fully online degrees, highlighting the need for organizational support, collaboration, and community building. Their research highlights the importance of involving educators in designing online programs and recognizing managers, coordinators, and educators as key stakeholders.

Bolliger and Wasilik (2009) identified faculty satisfaction as critical in online teaching, influenced by instructor, student, and institutional factors. A UNESCO report noted positive teacher attitudes toward online learning during COVID-19, despite mixed views on its effectiveness. Teachers worldwide adapted to online formats, though challenges remain (Rahayu & Wirza., 2020). Smith, D. E., & Mitry, D. J. (2008) argue that the potential of e-learning depends on universities meeting high academic standards for faculty expertise. Similarly, DeFleur and Adams (2004) found that online bachelor's degrees are not seen as equally acceptable for graduate admissions.

Adcock (2023) explored the social perception of online degrees, particularly in tech fields, while Ortagus, J. C., Hughes, R., & Allchin, H.(2023) noted higher completion challenges in fully online programs, especially among minority and low-income students at for-profit institutions, recommending policy changes to support retention. Panda and Kaur (2023) highlighted the rise of digital credentials and the need for standardization to improve accessibility and employability.

To minimize logistical barriers, providing e-learners with reliable internet and devices is essential, and some institutions now offer devices to admitted students (Pallavi, D. R., Ramachandran, M., & Sathiyaraj, C., 2022). Research on modality effectiveness has assessed traditional and online learning in terms of course objective fulfilment, student satisfaction, and completion rates (Levterova-Gadjalova, D., & Tsokov, G., 2021). Despite noted constraints, online education expands learning opportunities with support from UGC interventions and NEP 2020. Online higher education continues to gain acceptance among lifelong learners, driven by the demands of an evolving VUCA world (Mack, O., & Khare, A., 2016).

As the second-largest e-learning market, with a user base of around 9.5 billion, India highlights the urgent need for online degree standards, aligning with the Government of India's goal to achieve a 50 per cent GER in higher education by 2035. Industry forecasts predict that the Indian online education market will reach $8.6 billion by 2026 (Saini, N., 2023).

Research Gaps

State of the art focuses on the perceptions of various stakeholders and the acceptability of online degrees among employers, faculty, students, outcome and societal acceptance. Most of the studies focussed on the challenges and opportunities leveraged by online degrees by its stakeholders but none focussed on the views, opinions, apprehensions, challenges, anxiety levels and choices of students.

Research Objectives

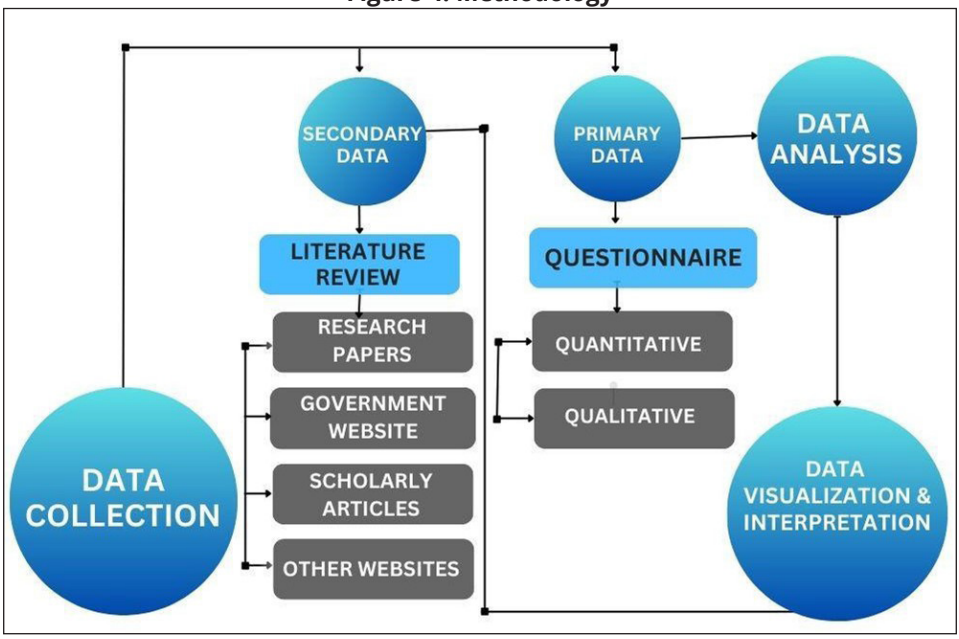
1. To explore student perceptions about online and traditional degree programs, their views on the reliability and future potential of online education, and the perceived value in the job market.
2. To identify the challenges students face in online degree programs, including issues related to motivation, technology access, engagement, and the impact of UGC guidelines on dual and joint degree programs on students' choices and experiences.
3. To examine the benefits and opportunities students gain from online education, such as flexibility, career development, and overall satisfaction compared to traditional or hybrid education formats.

4. To offer insights that can help devise policies and strategies for enhancing the quality, accessibility, and future potential of online degree programs.

Methodology

Data was collected from primary and secondary data sources. Primary data source consisted of an online survey comprising a questionnaire that was circulated among students of age ranging 16 to 50. Statistical data analysis was performed on the data collected to gather insights into viewpoints of students. Secondary data was used to perform literature review to identify research gaps. A concise overview of the methodology is presented in Figure 4.

Figure-4: Methodology



Primary Data Sources

The survey participants primarily consisted of students who were enrolled in one of three categories: traditional degree programs, online degree programs, or a combination of both. The sample was diverse, encompassing individuals from various socio-economic backgrounds, geographical regions, genders, age groups and a wide array of academic disciplines.

The survey form was distributed through social media platforms such as Telegram, Instagram, Whatsapp, and Facebook. A total of 618 responses were collected from individuals across these platforms. The survey questionnaire comprised three sections, with each participant completing two of them. The first section gathered preliminary demographic information about the participants, while the subsequent two sections aimed to understand the perceptions of students, both those pursuing online degrees and those not pursuing them. Further analysis was conducted to discern the distinctions between online and traditional educational experiences in the Indian context.

The statistical and visual analysis of the data collected from the survey, which was administered through Google Forms was performed using Microsoft Excel. The survey questionnaire encompassed both quantitative items, designed to objectively analyze the challenges faced and opportunities gained by respondents in the online learning modality, and qualitative items, intended to subjectively capture the views, opinions, perceptions, experiences, attitudes, and beliefs of respondents concerning online higher education. It also delves into factors such as stress levels, anxiety, and motivation among students in the context of NEP dual degree programs and online degrees offered in India. Table 1 provides details of the survey.

Table-1: Survey details

Research Design	Exploratory cum descriptive
Population	Students belonging to rural as well as urban area
Sampling Unit	Students pursuing online and offline degree courses
Sample Size	618
Sampling Area	India (North, West and East India)
Source of data collection	**Primary:** Questionnaire **Secondary:** Journals, Research papers, Scholarly articles, Government websites, Private Institution websites and the Internet.
Survey Form	Google form: https://forms.gle/qzjxyrrggzx5eRrQ6

Secondary Data Sources

The project conducted a comprehensive literature review using various secondary data sources, including journals, reports, government websites, private institution websites/ portals, research papers, scholarly articles, and academic publications, to explore the opinions and perceptions of different stakeholders regarding online degrees. Data from 2004 to 2024 were searched using keywords such as “Online degree,” “Online graduation,” “Online degree course,” and “Online education.”

About the Survey Conducted

The survey was conducted to gather insights on students’ experiences, challenges, opportunities, and perceptions regarding online degree programs, especially in the context of India’s educational reforms, such as the National Education Policy (NEP) 2020 and UGC’s approval for multiple-degree provisions. The survey was divided into three sections: one for students currently pursuing online degrees, one for students not pursuing online degrees, and a section on personal engagement and future perceptions. Figure 5 illustrates a summary of questions that were asked in the survey.

Figure-5: Questionnaire Details

PERCEIVED HELPFULNESS & ENGAGEMENT
To what extent do you feel online degree programs help in developing a global perspective or provide exposure to international learning opportunities?
This aims to evaluate how online degrees facilitate global exposure and cross-cultural learning, particularly important in a globally connected world.
How helpful do you find the learning tools and resources (e.g., virtual classrooms, recorded lectures, discussion forums) provided in online degree programs?
This question focuses on the perceived effectiveness of the online learning environment, evaluating tools that aid learning.
PREFERENCES AND FUTURE INTENTIONS
If given the opportunity, would you prefer to pursue a hybrid learning model (a mix of online and offline courses) for future degrees? Why?
This explores the preference for a balanced approach to learning, combining both traditional and online methods.
Would you be open to pursuing multiple online degrees simultaneously in the future? What factors would influence your decision?
This question addresses the growing trend of dual degree programs and what factors (such as time, stress, career goals) would impact students' decisions.
COMPETITIVENESS AND CAREER IMPACT
How do you think the ability to pursue multiple degrees simultaneously will affect the overall competitiveness in the job market?
This probes students' views on how UGC's multiple-degree provision could affect job prospects and whether it creates additional competition.
STRESS, ANXIETY, AND MENTAL HEALTH
How do you manage stress and anxiety when balancing online degree courses with other commitments such as work or traditional studies?
This question will provide insights into coping mechanisms and mental health challenges specific to online education.
In your opinion, how does the lack of face-to-face interaction in online degree programs impact your anxiety levels or sense of isolation?
This explores the psychological effect of online education on students, particularly regarding social interaction and isolation.
Do you feel that pursuing an online degree provides you with adequate support to manage academic and personal stress?
This question evaluates the level of support (if any) available to online students for mental health and stress management.
STRENGTHS & WEAKNESSES
What strengths do you believe online degree programs offer in terms of skill development, self-discipline, and career advancement?
This aims to understand what students perceive as the key strengths or advantages of online education.
What do you think are the major weaknesses of online degree programs compared to traditional classroom-based learning?
This question investigates the perceived drawbacks of online learning from students' perspectives, such as lack of engagement or networking opportunities
OPPORTUNITIES AND FUTURE PROSPECTS
How do you see the growth of online degree programs influencing your career prospects in the next 5 to 10 years?
This question assesses students' views on the long-term value of online degrees in terms of career opportunities and advancement.
Do you think the expansion of online education, as encouraged by NEP 2020 and UGC guidelines, will create more opportunities for students to pursue a diverse range of skills?
This investigates students' perceptions of how the policy reforms might create more career pathways and skill development opportunities.
In your opinion, how does the lack of face-to-face interaction in online degree programs impact your anxiety levels or sense of isolation?
This explores the psychological effect of online education on students, particularly regarding social interaction and isolation.

Results and Discussions

Analysis of the data gathered through the survey provided critical insights about the viewpoints, encounters, impressions, obstacles encountered and advantages gained by students pursuing online degree programs. In the following sections, we present its findings and outcomes.

1. Demographic, and Geographic Information

A dominant 96.76 per cent of respondents were aged between 16 and 25 years, indicating that the online learning model is particularly appealing to younger, tech-savvy individuals. This aligns with broader trends in online education, where younger students are often more adaptable to the digital format of learning.

81 per cent of survey respondents reside in urban areas, with a significant proportion (37.5 per cent) coming from Delhi, Gender-wise, females made up 71 per cent of the total respondents, followed by 18.0 per cent from Haryana and 17.6 per cent from Uttar Pradesh, highlighting regional concentration in the survey's responses.

2. Opinion with regard to the new UGC Guidelines

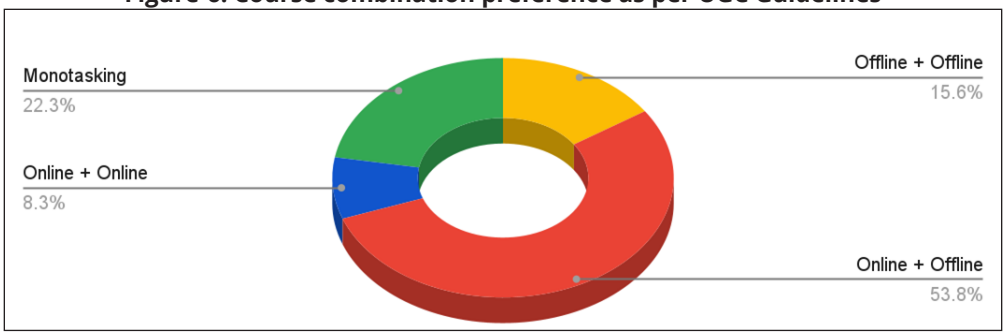
The introduction of new UGC guidelines, allowing students to pursue dual degrees simultaneously, has sparked intriguing questions regarding the choices and stress levels among students.

3. Course combination preference

Figure 6 reveals that 53.8 per cent of students expressed a preference for combining an online degree with a traditional offline program. Following closely, 22.3 per cent of participants favoured pursuing a single degree at a time, while 15.6 per cent opted for a combination

of two offline degree courses. The least favoured option, chosen by 8.3 per cent of respondents, was the pursuit of two online degree courses.

Figure-6: Course combination preference as per UGC Guidelines



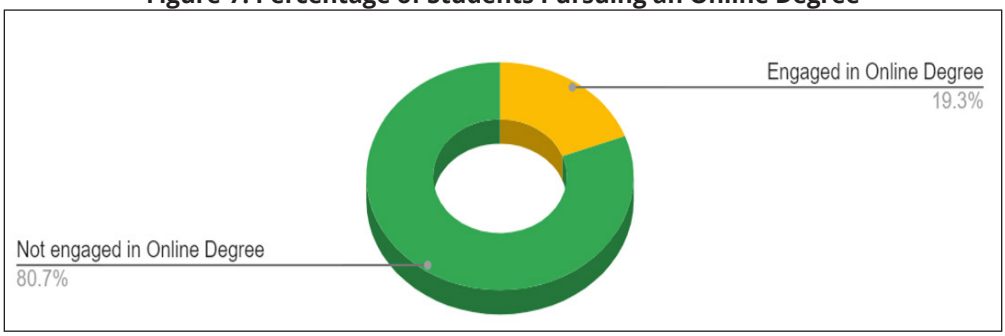
4. Stress Levels Perceived due to dual degree UGC Guidelines

A significant portion of students (67.8 per cent) expressed concern that the introduction of the UGC's dual-degree guidelines would increase their stress levels. while 33.2 per cent disagreed with this anticipation. Among those anticipating higher stress, 24.8 per cent see it as a challenge they are willing to face. Conversely, 15.6 per cent of those who disagree believe that recent developments in education and specialization justify these changes, reducing perceived stress. These findings illustrate the multifaceted attitudes and factors influencing stress perceptions in light of the UGC guidelines and shed light on the mental health challenges associated with pursuing online degrees.

5. Survey of Stu5.dents Pursuing an Online Degree

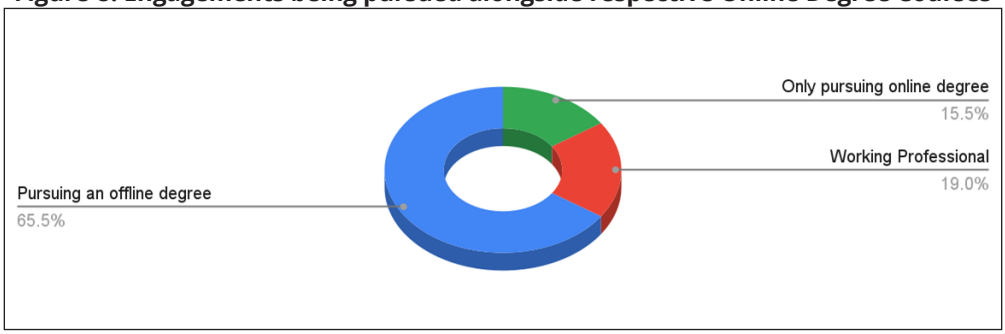
19.3 per cent of the surveyed participants, as shown in Figure 7, are currently engaged in online degree programs. These respondents were queried about the most favourable and unfavourable aspects of online degree programs. They were also prompted to share their personal experiences, perceptions, obstacles they encountered, and the opportunities they have garnered through their online educational endeavours. They also provided a subjective summary of their overall perspective on the matter.

Figure-7: Percentage of Students Pursuing an Online Degree



Notably, 65.5 per cent of online degree students simultaneously pursue traditional offline degrees, 19 per cent are working professionals, and 15.5 per cent exclusively focus on online degrees, as shown in Figure 8. This suggests that students prefer a balance between online learning's flexibility and the interactive, engaging nature of in-person education.

Figure-8: Engagements being pursued alongside respective Online Degree Courses



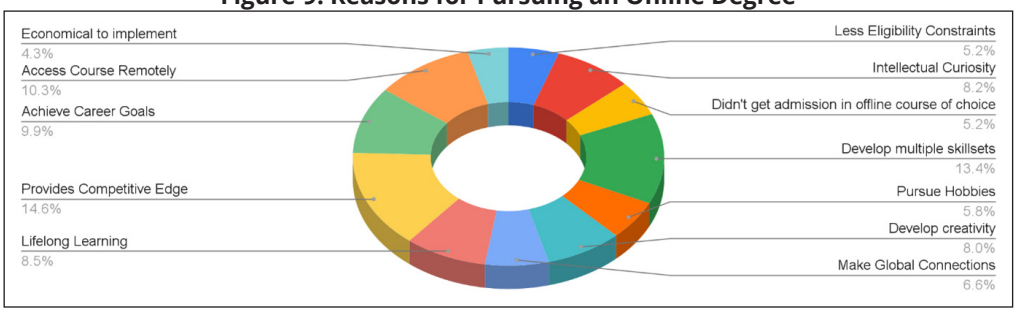
5.1 Popular Fields for Online Degree Courses

The preference among online degree students for emerging fields like data science, programming, digital marketing, AI, and machine learning reflects the strong market demand for expertise in these areas. The limited offline options for such cutting-edge subjects further push students towards online platforms to gain relevant skills. This shift underscores the value of online education in providing career-focused, in-demand technical skills.

5.2 Reasons for Pursuing an Online Degree

A variety of reasons, as depicted in Figure 9, were identified for pursuing an online degree, with the most frequently mentioned being the desire for a competitive edge, cited by 14.6 per cent of respondents. 13.4 per cent expressed the need to develop multiple skill sets, while 10.3 per cent highlighted the convenience of pursuing a degree from the comfort of their homes. Additionally, 9.9 per cent cited the pursuit of online degrees to help fulfil their career goals, 8.5 per cent mentioned the development of lifelong learning habits, and 8 per cent emphasized the enhancement of creativity as a motivating factor for their choice.

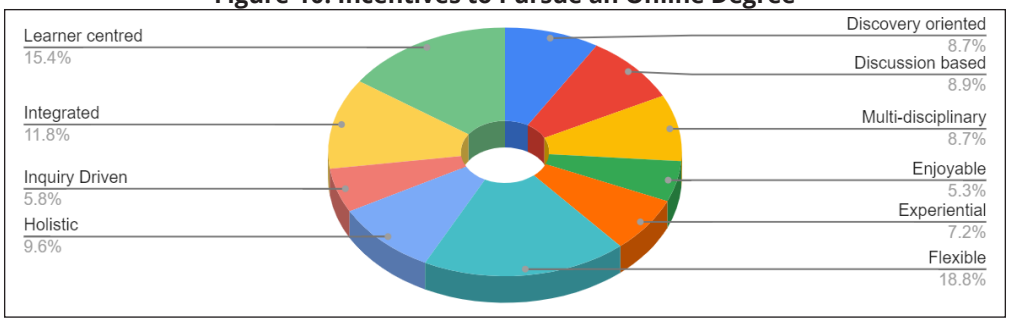
Figure-9: Reasons for Pursuing an Online Degree



5.3 Incentives to Pursue Online Degree Courses

Students currently pursuing online degree courses mentioned several advantages that motivated their choice over traditional offline degrees, as displayed in Figure 10. The most significant factors include the flexibility offered by online programs 18.8 per cent, learner-centric course pedagogy 15.4 per cent, integrated learning 11.8 per cent, a holistic educational approach 9.6 per cent and the opportunity for discussion-based learning 8.9 per cent. Respondents also valued the discovery-oriented and multidisciplinary nature of online education at 8.7 per cent and the possibilities for experiential learning at 7.6 per cent.

Figure-10: Incentives to Pursue an Online Degree

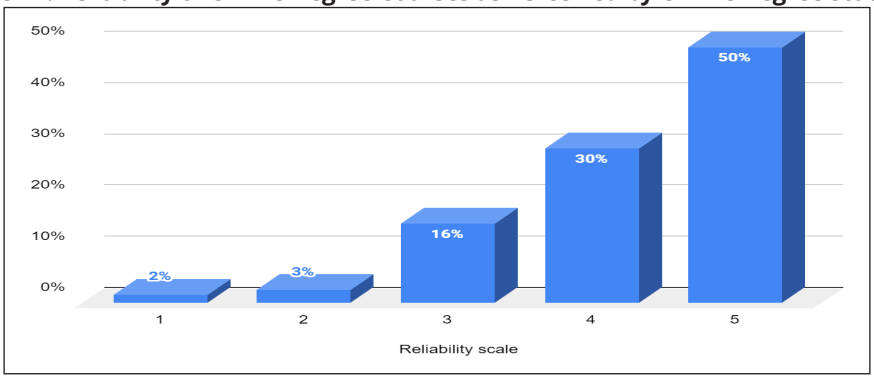


5.4 Reliability of Online Degrees

Online degree courses garnered high reliability ratings among online degree respondents, with 48.72 per cent rating them as highly dependable. The average reliability score of 4.2 indicates that online degree students generally view these courses as very reliable. Figure 11 displays the reliability rating scale. These statistics prove the widespread perception of online degrees as trustworthy among students actively involved in these programs. However, this perception is not universal. Adcock (2023) reported in his work that employer scepticism toward online degrees persists, particularly for advanced roles in fields such as technology. Employers often view online degrees as less rigorous compared to traditional degrees, potentially affecting graduates' career prospects.

However, the survey's findings indicate that this perception may change, with students showing greater confidence in the reliability of online degrees and as more students graduate from reputable online programs, employers may begin to view online degrees with greater legitimacy.

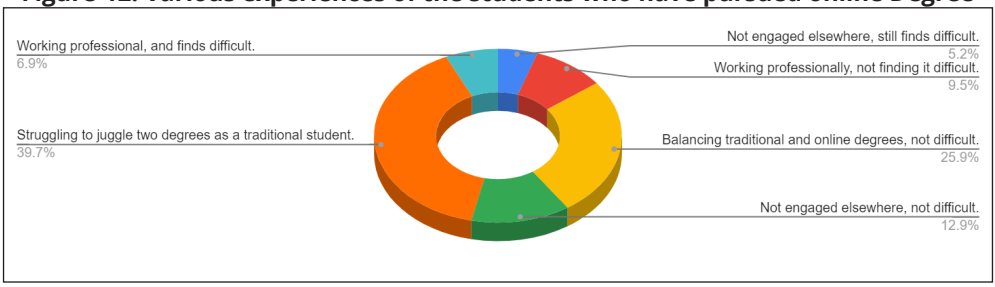
Figure-11: Reliability of Online Degree Courses as Perceived by Online Degree Students



5.5 Experiences in Pursuing an Online Degree

A crucial aspect of the experiences of students pursuing an online degree is the manageability of course load. Among respondents pursuing traditional offline degrees, 51.8 per cent find the course load challenging to manage, while 48.2 per cent deem it manageable. Among the total respondents, 9.5 per cent who are working professionals find the workload easy to manage, whereas 6.9 per cent of working professionals find it difficult to balance their engagements. Lastly, among respondents without any additional engagements, 71.4 per cent consider the course load easy to manage, while 28.57 per cent find it difficult to handle as depicted in Figure 12.

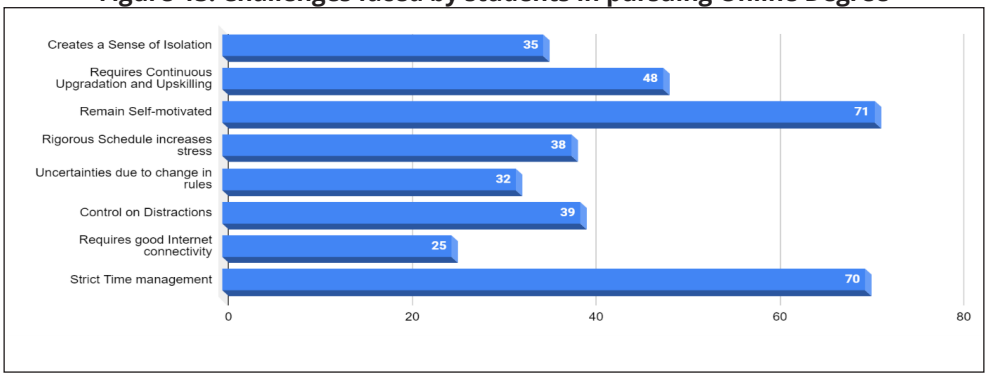
Figure-12: Various experiences of the students who have pursued online Degree



5.6 Challenges in Pursuing an Online Degree

Exploring the challenges faced by students pursuing online degree programs, several key difficulties were identified. The most prominent challenges included a lack of self-motivation and time management issues (19.6 per cent), followed by competitiveness arising from the need for constant upskilling (13.4 per cent). Additionally, some students encountered challenges related to maintaining continuous and rigorous schedules and managing distractions in the online learning environment (10.9 per cent). Other challenges included a lack of social interaction (9.8 per cent), uncertainties due to changing rules (8.9 per cent), and a lack of necessary infrastructure (7 per cent), as depicted in Figure 13.

Figure-13: Challenges faced by students in pursuing Online Degree

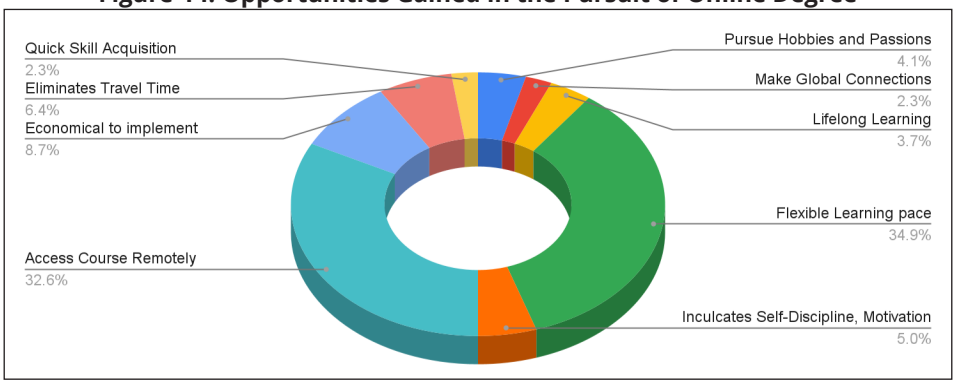


These findings echo concerns raised by Ortagus et al. (2023) that online students must develop self-regulated learning behaviors to succeed, as the lack of structure and in-person interaction can lead to disengagement and time management challenges, ultimately affecting academic performance.

5.7 Opportunities Gained

It's crucial to understand the motivations that drive students to continue their online degree pursuit. Key opportunities gained from online degrees, as displayed in Figure 14, include a flexible course structure (34.9 per cent), the convenience of studying from home (32.6 per cent), and financial savings (8.7 per cent). Additionally, students noted the growth of self-discipline and motivation (5 per cent), opportunities to pursue hobbies and passions (4.1 per cent), time saved on commuting (6.4 per cent), ease of connecting with a diverse global community (2.3 per cent), and the development of lifelong learning habits (3.7 per cent). Lastly, 2.3 per cent appreciated the ease of acquiring new skills through online education.

Figure-14: Opportunities Gained in the Pursuit of Online Degree



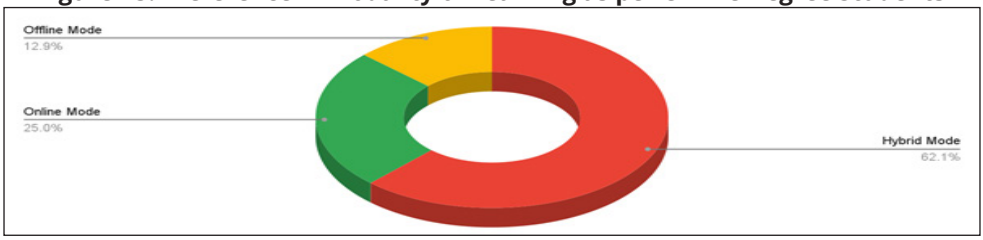
These benefits underscore the appeal of online education, particularly for non-traditional students such as working adults or those with caregiving responsibilities.

5 per cent of respondents who reported increased self-discipline and motivation as benefits of online learning support the claim made by Ortagus et al. (2023) that online education, while challenging, fosters essential skills such as time management and self-motivation.

5.8 Preferred Mode of Learning

Among online degree students, 62.1 per cent prefer the hybrid learning mode, while 25 per cent favour the fully online mode, and 12.9 per cent opt for traditional in-person learning as shown in Figure 15. These preferences highlight the diversity in learning modality preferences.

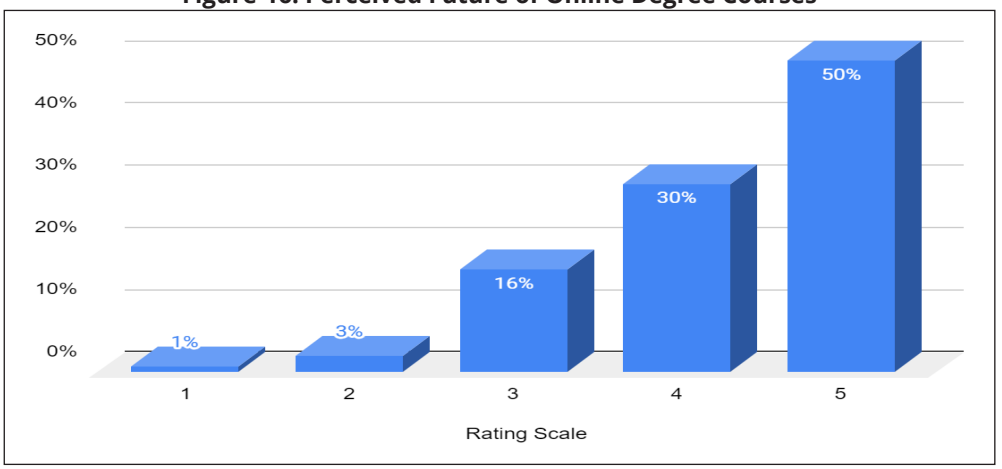
Figure-15: Preference in Modality of Learning as per Online Degree Students



5.9 Opinion on the Future of Online Degree Courses

Exploring the outlook for online degree programs within the context of UGC's multiple-degree approval, as shown in Figure 16, a significant majority of 50.42 per cent participants are notably optimistic, rating the future as very bright (score of 5). Subsequently, 29.9 per cent express a positive outlook, deeming it bright, while 16.2 per cent maintain a neutral stance. On average, with a rating of 4.26, participants generally perceive the future of online degree courses as promising, which aligns with recent trends predicting a shift towards online and hybrid models in higher education.

Figure-16: Perceived Future of Online Degree Courses



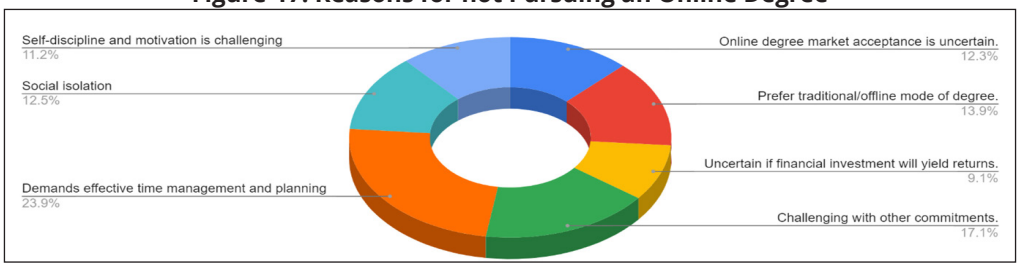
6. Survey of Students not Pursuing an Online Degree

Most of the respondents in this category were engaged in traditional bachelor's programs. and not currently enrolled in online degree programs. Their perspectives were recorded and compared to those participants who were part of online courses. This comparison aimed to identify any significant differences in perceptions of online education between those who are already part of online degree programs and those who remain in conventional educational tracks.

6.1 Reasons behind not pursuing an Online Degree

One key aspect of students opting not to pursue online degrees is understanding their deterrents as depicted in Figure 17. The majority of respondents highlighted the demanding nature of time management and meticulous planning (23.9 per cent) as a significant challenge. This was followed by difficulty in balancing other commitments (17.1 per cent), a preference for traditional in-person learning (13.9 per cent), demotivation due to the lack of social interaction (12.5 per cent), uncertainty about the acceptance of online degrees in job markets (12.3 per cent), and the requirement for self-discipline and motivation (11.2 per cent) as influential factors in their decision-making process.

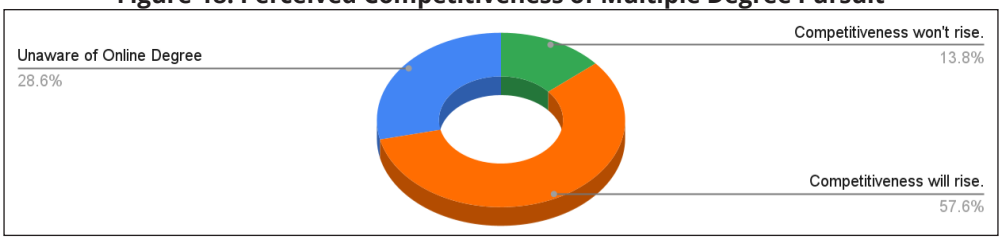
Figure-17: Reasons for not Pursuing an Online Degree



6.2 Opinion regarding Competitiveness

Figure 18 examines the impact of the new UGC Guidelines on educational competitiveness; 57.6 per cent of participants not currently pursuing online degrees anticipate increased competition among their peers. Surprisingly, 28.6 per cent were unaware of these guidelines, indicating a lack of information, while 13.8 per cent believed that educational competitiveness would remain unchanged.

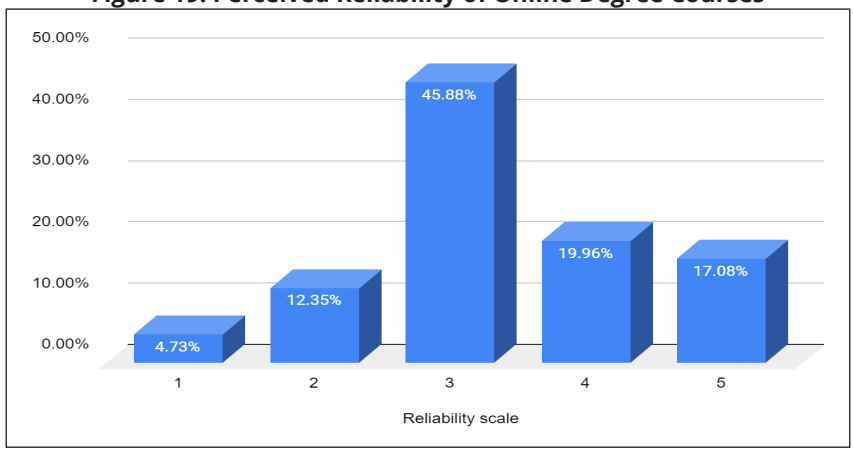
Figure-18: Perceived Competitiveness of Multiple Degree Pursuit



6.3 Perceived Reliability of Online Degree Courses

Figure 19 reveals the reliability rating of participants not currently pursuing online degree programs. Results indicate that 45.8 per cent view online degrees as neutrally reliable, without strong convictions of reliability or unreliability; 37.04 per cent find online degrees reliable, while 17.08 per cent consider them not very reliable. On average, the respondents' rating of 3.32 suggests a generally neutral stance, indicating a lack of strong opinions regarding the reliability of online degrees.

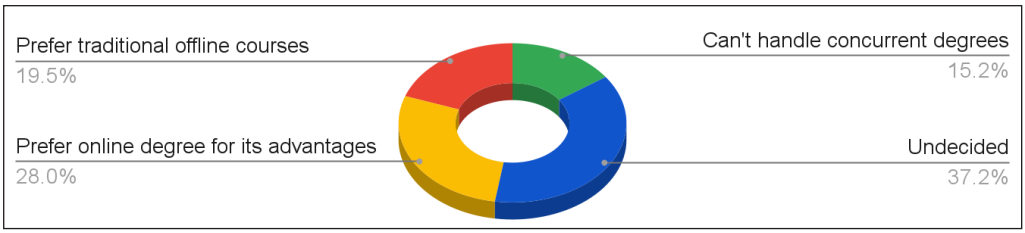
Figure 19: Perceived Reliability of Online Degree Courses



6.4 Future Plans to Pursue an Online Degree

When contemplating future plans for pursuing online degrees with resolved challenges, participants displayed diverse responses, as shown in Figure 20. Approximately 37.2 per cent have no specific plans at present but are open to considering online degrees in the future. 28 per cent express a definite intention to pursue online degrees, citing their advantages. 19.5 per cent intend to adhere to traditional learning methods, while 15.2 per cent plan to individually pursue online degrees due to the challenge of managing two degrees simultaneously. These insights offer a snapshot of participants' varied future considerations for online degree pursuits when potential obstacles are addressed.

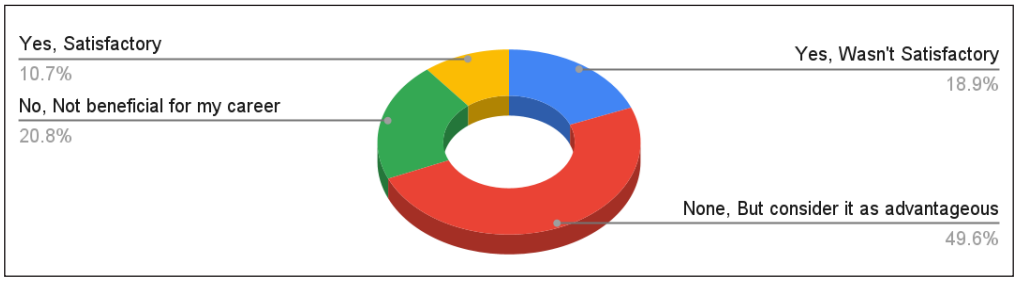
Figure-20: Future Plans to Pursue Online Degrees



6.5 Prior Experience in Pursuing an Online Degree

Figure 21 highlights that a significant majority, 70.4 per cent of participant's not currently pursuing online degrees, have no prior experience with such programs. Among them, 49.6 per cent express an intention to explore online degrees in the future, citing perceived advantages, while 20.8 per cent deem online degrees irrelevant to their career and educational aspirations. Among 35.9 per cent with previous online degree experience, the majority, 63.8 per cent, found it unsatisfactory for their career and educational goals, while a minority, 36.1 per cent, found it suitable. Overall, the survey portrays mixed sentiments, with 60.3 per cent holding a positive view of online degrees and 39.7 per cent expressing a negative perspective.

Figure-21: Prior Experiences in Pursuing an Online Degree Course

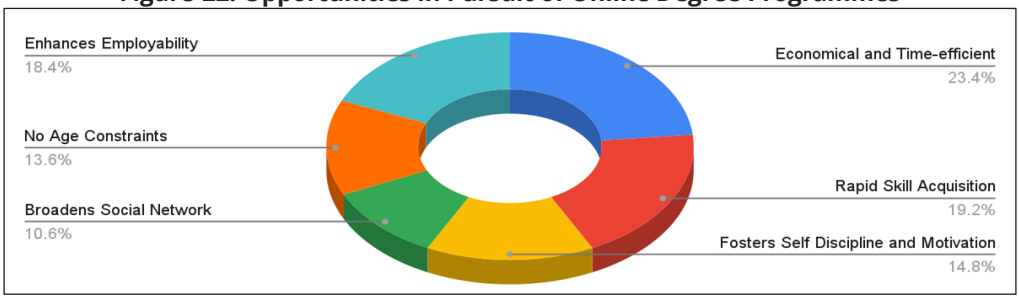


6.6 Perceived Opportunities in Online Degrees

The consideration of available opportunities for participants contemplating future online degree pursuits is significant. Figure 22 reveals that 23.4 per cent of respondents believed that online degree courses would demand fewer financial and time resources, while 19.2 per cent thought they could rapidly acquire the necessary skills. Additionally, 18.4 per cent felt that choosing the right course from a

reputable institution would guarantee employability. About 14.8 per cent saw it as a means to foster self-motivation and discipline, while 13.6 per cent believed that issues like age-agnosticism and social challenges like ragging and bullying would be resolved. Finally, 10.6 per cent saw it as a potential for expanding their social circles in terms of diversity as an opportunity.

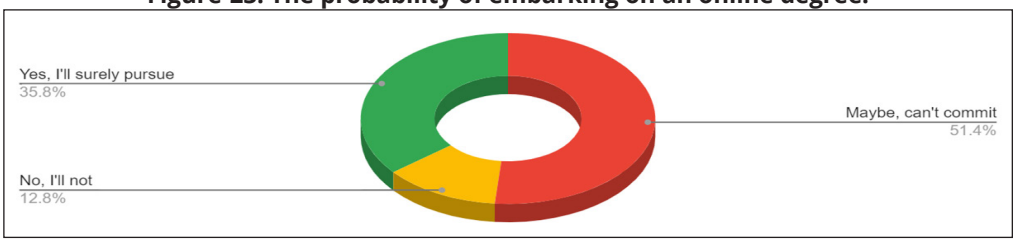
Figure-22: Opportunities in Pursuit of Online Degree Programmes



6.7 Likelihood of Pursuing an Online Degree

Considering the diverse perspectives discussed earlier, respondents were asked about their inclination to pursue an online degree if their current constraints were resolved. Figure 23 shows that 51.4 per cent are uncertain and open to the possibility while 35.8 per cent express a strong intention to pursue such a course, while 12.8 per cent are certain they would not pursue an online degree course under any circumstances. These responses depict the varying attitudes and intentions among the surveyed participants regarding online degree pursuit if barriers were eliminated.

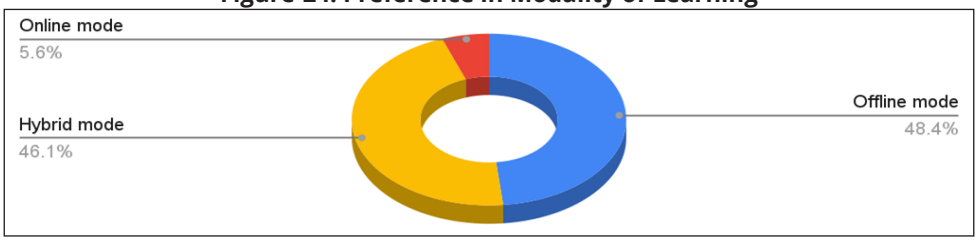
Figure-23: The probability of embarking on an online degree.



6.8 Preferred Mode of Learning

While acknowledging that many respondents not pursuing an online degree lack direct experience with the online mode of learning, their perspectives on the most favourable learning mode are notable. Among these participants, the majority, 48.4 per cent, favoured traditional offline learning, 46.1 per cent expressed a preference for a hybrid learning approach, and a smaller proportion, 5.6 per cent, favoured fully online learning, as shown in Figure 24. These preferences highlight the growing significance of online mode as a complement to traditional, in-person learning for this group despite their limited exposure to online education.

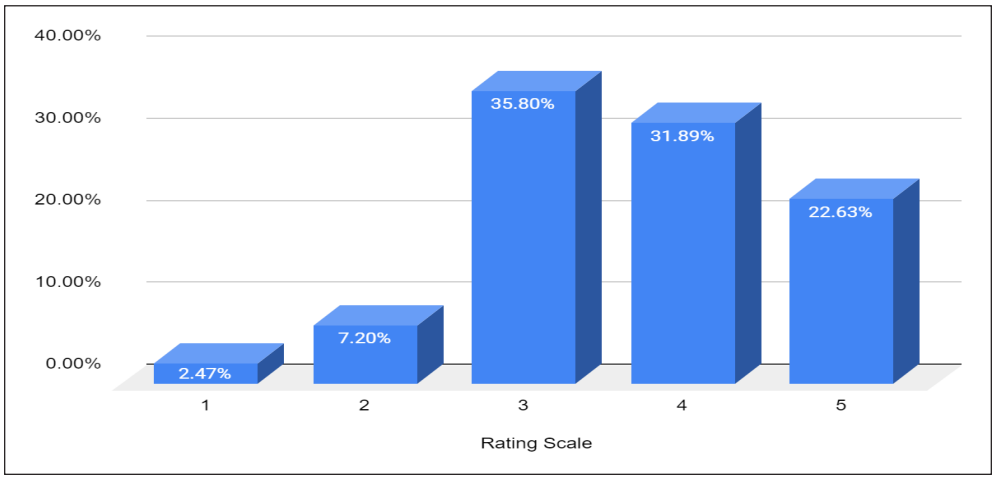
Figure-24: Preference in Modality of Learning



6.9 Opinion on the Future of Online Degree Courses

Considering the UGC's Multiple-degree approval initiative, participants were surveyed to assess their outlook on the future of online degree courses. Results shown in Figure 25 reveal that a significant portion, 35.8 per cent, consider the future moderately bright, with a rating of 3. Meanwhile, 31.8 per cent hold a neutral stance, and 9.6 per cent express optimism, rating the future as very bright. The overall average rating of 3.65 suggests that respondents maintain a neutral perspective on the future of online degrees. They neither view it as excessively promising nor overly pessimistic, reflecting a nuanced perception of the potential outcomes of this educational shift.

Figure-25: Perceived Future of Online Degree Courses



Comparative Analysis

F-Test of Reliability Rating

An f-test of the sample for Variances was performed on the reliability scores given by students currently pursuing online degree programs and those who are not pursuing any online degree program. For online reliability, the mean score is approximately 4.24, with a variance of about 0.86, based on 116 observations. For offline reliability, the mean score is approximately 3.32, with a variance of about 1.09, based on 486 observations, as shown in Table 2.

The F-statistic, which measures the ratio of the variances, is 0.789278. When we compare this value to the critical F-value of 0.776836 for a one-tail test, we find that the calculated F-statistic does not exceed the critical value. Additionally, the p-value (P(F<=f)) of 0.061525, which represents the probability of obtaining such an F-statistic by random chance, is greater than the commonly used significance level of 0.05. F-test results indicate that variances between online and offline reliability scores differ significantly, revealing the difference in perceptions of viewpoints of students.

Table-2: F-test Two-Sample for Variances comparing the reliability scores between online and offline

Modality	Online	Offline
Mean	4.241379	3.323045
Variance	0.862969	1.093365
Observations	116	486
df	115	485
F	0.789278	
P(F<=f) one-tail	0.061525	
F Critical one-tail	0.776836	

F-Test for the Future of Online Degree Programs

F-Test Two-Sample for Variances was conducted for the future scenario of online degree programs in India to compare the variances of ratings given by students pursuing online and offline degree programs. The mean score of students pursuing an online degree is 4.258621, with a variance of 0.784708, based on 116 observations. For offline degree students, the Mean score is 3.650206 with a variance of 0.974299, based on 486 observations, as shown in Table 3. The calculated F-statistic is 0.805407, indicating the ratio of variances between online and offline reliability scores. In this case, the probability of obtaining an F-statistic as extreme as 0.805407 (or more extreme) by random chance (P(F<=f)) is 0.079157. When compared with the critical F-value of 0.776836 for a one-tail test, which is the threshold beyond which the results are considered statistically significant, the calculated F-statistic of 0.805407 is greater. The F-test suggests that students' belief in the future of online degree programs, as perceived by online degree programs, is statistically significantly different from the offline reliability scores. This indicates a meaningful difference in the variability between these two groups.

Table-3: F-test Two-Sample for Variances conducted for the future scenario

Modality	*Online*	*Offline*
Mean	4.258621	3.650206
Variance	0.784708	0.974299
Observations	116	486
df	115	485
F	0.805407	
P(F<=f) one-tail	0.079157	
F Critical one-tail	0.776836	

Limitations and Drawbacks of the Study

The study's limitations include its limited generalizability due to a sample primarily composed of students aged 16-25, mostly female, and from north Indian urban areas like Delhi, Haryana and Uttar Pradesh which restricts applicability to a broader demography. Self-reported survey data introduces potential biases, as it may not accurately reflect objective challenges faced in online education. The cross-sectional design captures perceptions only at one point in time, missing potential shifts in attitudes as online education evolves. Additionally, the study lacks sufficient representation of non-traditional students, such as working professionals, and a narrow geographic focus may not capture regional disparities in access to technology and internet connectivity. The study's limited exploration of technological barriers overlooks significant challenges for students in rural areas. These constraints highlight the need for future research incorporating diverse demographics to create a more comprehensive understanding of online degree programs.

Conclusion

This study highlights the increasing relevance of online degrees, among urban students aged 16-25, mostly female, with gradual acceptance in rural areas. New UGC guidelines permitting dual degrees prompted many respondents to undertake a combination of online and traditional degrees, though many anticipated it added stress. Popular fields among online degree students include data science, AI, and digital marketing, driven by the demand for industry-aligned skills. Flexible course structures were a major draw, while time management and self-motivation presented challenges. Respondents not enrolled in online programs cited concerns about time and planning, though many expressed openness to enrolling in online degrees in the future. The study demonstrates a positive shift towards online education for skill enhancement, yet widespread acceptance relies on technological, policy, and industry alignment. Overall, online degrees are seen as valuable but require more integration into mainstream education opportunities to fully meet educational and career demands. These findings suggest that the structure of online programs if designed effectively, can promote the development of skills that are beneficial in both academic and professional settings.

(Acknowledgment: We extend our sincere thanks to the Centre for Research at Maitreyi College for their unwavering support, guidance, and resources and to all the respondents for sparing their valuable time in sharing their feedback about online and dual degree programs. Special thanks to Lavanya for her assistance in data collection.)

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Review Article

Management on the Silver Screen: Transforming Learning through Cinema

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Abstract

The present article aims to explore the existing literature available on the use of movies as a pedagogy to teach management in higher education, along with the discussion on the advantages and barriers to the use of movies as pedagogy for management education and also suggesting the scope use of movies to teach management in the Indian context. The literature review underscores the importance of research literature in identifying gaps and justifying investigations. To ensure quality, only peer-reviewed works from Scopus (2013-2024) were considered, resulting in 820 articles. Ten papers, meeting specific criteria and focusing on movies, pedagogy, teaching, management, and higher education, were ultimately selected for review. The inclusion criteria involved articles published exclusively in peer-reviewed journals and those written in English. The study reveals enhanced learning effectiveness with the use of movies as a teaching tool over traditional ones. Current-generation students exhibited heightened engagement and enjoyment with this way of learning. The study advocates for educators to use movies as a pedagogical tool for more interactive, experiential classrooms to leverage the benefits of this tool effectively. However, the study focuses solely on teaching a management course. This study is limited to the revisiting of existing literature concerning the use of movies as a pedagogical tool to teach management only from Scopus and Google Scholar. There are many other databases that can provide more insight into the context of novel dimensions applicable to the use of movies to teach management and other courses effectively in India. Movies as a pedagogical tool in higher education for management provide practical benefits, enhancing engagement, catering to diverse learning styles, and fostering cultural sensitivity. They bridge theory and application, promote critical thinking, and facilitate discussions on ethics, offering flexibility and cost-effectiveness. Movies as a pedagogical tool in higher education for management studies offer benefits such as enhanced engagement, accessibility, and diverse perspectives. However, challenges include stereotyping, misrepresentation, and a potential compromise in academic rigour, raising concerns about the limited real-world application and the interpretative nature of movies. This study navigates a literary quandary, championing roleplays' educational efficacy yet acknowledging their waning relevance amid technological exposure. Uniquely, it delves into fostering increased student engagement, distinguishing itself through a focus on enhancing classroom participation.

Keywords: Cinema, Movies, Films, Management, Teaching, Pedagogy and Higher Education

Introduction

In the contemporary landscape, higher education's role in management education is paramount, moulding future leaders for the dynamic global business scene. Beyond traditional disciplines, specialized programs offer multifaceted insights into organizational dynamics, strategic thinking, and leadership. Real-world

case studies, industry interactions, and practical experiences foster a holistic learning environment. The integration of emerging technologies and sustainability addresses modern organizational challenges. Management education emphasizes soft skills, critical thinking, and effective communication, recognizing interpersonal dynamics' significance. Interdisciplinary approaches blur traditional discipline boundaries, preparing students for a multicultural business world. Technology integration, including online platforms and data analytics, revolutionizes learning, reflecting the evolving workplace. As the business landscape transforms, management education remains pivotal in nurturing innovative, socially responsible leaders.

In today's world, management education is taking on a more interdisciplinary approach. The lines between fields like "finance", "marketing" and "human resources" are blurring as institutions focus on developing well-rounded individuals who can handle a wide range of challenges. Collaborative projects, teamwork and exposure to global perspectives are key elements helping students prepare for an increasingly multicultural and interconnected business environment.

Technology is also playing a major role in transforming management education. Online platforms, simulations and data analytics are now essential tools, offering students more interactive and immersive learning experiences. This digital shift not only makes education more accessible but also reflects the changing nature of the workplace.

In summary, management education today is dynamic and evolving. It goes beyond just teaching theory; it emphasizes practical skills, ethics, and adaptability. As the business world continues to change, management education is essential in shaping capable, innovative and socially responsible leaders ready to face future challenges.

The Genesis of Management Education in India

The dawn of management education in post-independence India emerged in the 1950s and 1960s, driven by the need for skilled professionals to manage growing industries. The Indian government initiated the establishment of institutes, notably the Indian Institutes of Management (IIMs) from 1961 onwards in Calcutta, Ahmedabad, and Bangalore. These institutions aimed to provide quality management education, contributing to economic progress. The curriculum evolved to address changing business dynamics, incorporating specialization in finance, marketing, human resources, and technology. Today, India's management education is diverse, with numerous business schools offering programs at various levels, fostering skilled professionals and contributing significantly to research and knowledge in the field. This development reflects a proactive response to economic challenges, laying the groundwork for India's emergence as a global economic performer.

Pedagogy

Pedagogy is both an art and a science, guiding the way we teach and learn. It shapes the entire educational process-from organizing lessons to selecting the best teaching strategies and developing a deeper conceptual framework for learning. At its core, pedagogy uses a variety of tools and methods to foster learning and shape a person's cultural and intellectual foundation (Semenovich, A., & T, 2022). Effective pedagogical practices do more than teach; they inspire curiosity, support knowledge acquisition and encourage both intellectual and personal growth. From signature teaching methods

and active learning techniques to competency-based curricula, educators tailor their approaches to meet the diverse desires of all students including those with special learning requirements (Mahyatun & Suryadi, 2022; Sabbagh, August 2022). Moreover, socially just pedagogies aim to empower and liberate students, particularly those from marginalized or disadvantaged communities. In essence, pedagogy is a rich, multidimensional field that integrates theories, principles and practices to create meaningful and impactful learning experiences for all.

The Power of Cinema: Transforming Education through Film

Using movies- a blend of moving images, dialogue, and sound effects has become an increasingly popular and effective tool for engaging students across a wide range of subjects in today's educational landscape (Arora Poonam & Yadav, 2022; Tedoradze, 2022). As a visual medium, films have a unique ability to captivate student's attention enriching the learning experience and making it more personalized (Kebaya & Mokaya, 2023; Sugesh & Calaivanane, 2023). By offering a sensory-rich experience, movies cater to different types of learners, enhancing both comprehension and retention (Kebaya & Mokaya, 2023). Movies engage multiple senses through their visual and auditory elements, making it easier for students to absorb and remember information (Arora Poonam & Yadav, 2022; Tedoradze, 2022). They also simplify complex concepts by presenting them in a more relatable and accessible way, enabling learners to make stronger connections with the material (Kebaya & Mokaya, 2023). Additionally, films promote critical thinking by encouraging students to analyze and interpret visuals cues and narratives, deepening their engagement and understanding (Kebaya & Mokaya, 2023). By incorporating movies into education, teachers can create an energetic and collaborative environment that fosters vigorous participation and deeper learning. Compared to traditional teaching methods, films offer a multisensory experience appealing to auditory-visual learners as well as those who thrive on multimodal learning. However, using movies in education does come with challenges. Integrating entertainment with learning can be tricky, even though it improves language and social skills (Sugesh & Calaivanane, 2023). Additionally, the trend toward shorter audiovisual materials due to modern technology may undermine the full benefits of films (Ljujić & Miljković, 2022; Parker, 2009). The success of using movies in the classroom also depends on proper guidance from instructors (Besek & Pandey, 2023). Furthermore, with students already surrounded by technology, they may become easily distracted, reducing the effectiveness of movies as an educational tool (Besek & Pandey, 2023).

Objectives of the Study

This article seeks (i) To delve into the current literature surrounding the use of movies as an educational tool, (ii) To examine the benefits and drawbacks of employing Indian movies as a pedagogical approach to management education, and (iii) To propose avenues for integrating movies into management teaching specifically within the Indian context.

Methodology

A literature review plays an essential role in research as it helps researchers familiarize themselves with prior studies, identify gaps in knowledge and justify the need for further exploration. To uphold the integrity of this research, only peer-reviewed articles from reputable scholarly journals were considered. The data for this study was sourced from

Scopus, the leading database for social sciences, covering more than a decade of insight from 2013-2024. The search was specifically confined to keywords, titles and abstracts, resulting in a total of 820 articles. The search terms were embedded within these elements, ensuring relevance to the gathered publications. Keywords such as "Movies," "Cinema," "Films," "Pedagogy," "Teaching," "Management," and "Higher Education" were specified to narrow the focus. Ultimately, 10 articles were chosen for in-depth analysis. To refine the literature further, specific filters were applied: Only articles published in peer-reviewed journals were included, and only those written in English were considered. This methodical approach ensured that the review highlighted the most pertinent literature in the field.

Findings

Movies play a transformative role in education by fostering comprehension, critical thinking and cultural awareness (Kebaya & Mokaya, 2023; Sugesh & Calaivanane, 2023). This approach encourages students to critically reflect on what defines a successful career, both for themselves and others, throughout the course of their professional lives (Tosti-Kharas & Levinson, 2024). They offer a visually captivating way to convey historical concepts, support language learning and cultivate social skills (Jalmav & Subekti, 2022; Ipek, 2022; Aravopoulou, Stone, & Weinzierl, 2017; Kataria & Kumar, 2024). By integrating films into the curriculum, educators enrich learning experiences, bridging the gap between theory and real-world applications (Kankal, Patra, & Panda, 2023) while also catering to diverse learning styles and encouraging active participation. Innovative pedagogy in management education involves leveraging films as a powerful teaching resource to enhance student engagement and understanding (Kankal, Patra, & Panda, 2023). The use of movies in pedagogy can be categorized into three paradigms: "Teaching Level," "Teacher-Student Interaction and "Student Learning" (Suresh & Kolluru, 2022). These frameworks aim to alleviate educator's anxieties and foster a more conducive learning environment for students (Aravopoulou, Stone, & Weinzierl, 2017). However, the integration of films in management education remains underutilized, often due to a fragmented approach where individual lecturers bear responsibility for quality and content. To address this issue, an integrated teaching approach such as the "Integrative and Interactive Approach", which combines design thinking with analytical reasoning is essential (Lee & Lo, 2014; Carr, Montano, Titera, & Hyman , 2024). Research indicates that repeated exposure to examples from films can enhance student's deductive reasoning when grasping management concepts. Similarly, guidelines for theory construction and reflective question can boost inductive reasoning skills (Lee & Lo, 2014). Educators are encouraged to adopt unconventional methods that promote academic success and foster positive attitudes in their students (Suresh & Kolluru, 2022). Feature films have become popular tools for illustrating various topics and concepts in management education, offering not only entertainment but also motivation. Yet, the potential of movies extends far beyond these functions. They can serve as theory-rich narratives that deepen student's understanding of complex management issues (Huczynski & Buchanan, 2006; Mathews, Fornaciari, & Rubens, 2012). Over time, films can influence emotional responses, perceptions and even personal lives, making them valuable for teaching leadership skills and management principles (Pasek, 2008). When selecting films, educators should consider contextual self-theory, taking into

account factors such as student's age and cultural backgrounds (Ilander, 2010). While the use of movies to teach entrepreneurship has been explored, it presents a unique opportunity (Huczynski & Buchanan, 2004). Analyzing film narratives can provide fresh insights into organizational processes and dynamics, enriching the field of management education.

A comparative study demonstrated that students who engaged in the innovative learning experience of watching accounting-related films and taking tests based on them achieved higher exam scores than their peers who did not participate. This highlights a significant positive impact on final exam performance (Merello, Barberá, Porcuna-Enguix, Porcuna-Enguix, & Zorio-Grima, 2023). The study involved 25 students and incorporated four films allowing learners to explore various idioms and improve their listening and speaking skills (Tedoradze, 2022). Students found the movie-based approach engaging and beneficial for enhancing their language and social skills, expressing highly positive attitudes toward it (Sugesh & Calaivanane, 2023; Kataria & Kumar, 2024). The study utilized a qualitative research design, employing open-ended questions with 38 English as Foreign Language teacher candidates selected through convenience sampling in a four-year ELT program. Thematic analysis revealed key themes and patterns in their responses (Ipek, 2022). Teaching English through films proved effective in creating exposure and providing the right context for language use. Movies help students connect language with real-life situations, a connection often lacking in traditional teaching methods. They also alleviate boredom and make the learning process more engaging (Arora Poonam & Yadav, 2022). The primary conclusion of the paper is that using films as teaching aids in Kenyan secondary schools enhances student's comprehension, focus and retention skills while developing a range of competencies including social, cultural, cognitive, critical and creative thinking-all essential components of a competency-based curriculum (Sugesh & Calaivanane, 2023). Visual media like cinema make management concepts more digestible and impactful compared to lecture-based methods. They cultivate critical thinking and equip students with essential managerial skills. Indian movies such as "Swadesh," "Rocket Singh," "Lagaan," "Corporate," and "Chak De! India" are widely utilized in management education. This paper delves into the significance of using films as an effective pedagogical tool in management education (Mantha, November 21, 2019). The study also highlights additional films which are easily and freely available on YouTube for teaching management, including "The Corporation," "Corporate," "Ek Kadam", and "The Guru."

Discussions

Real-World Applications

Incorporating movies as a vibrant pedagogical tool in management education at the higher education level offers transformative potential that significantly enriches the learning experience. The captivating visuals and compelling narratives of films elevate student engagement and participation, effortlessly translating abstract theoretical concepts into relatable scenarios that spark lively and thought-provoking discussions.

Furthermore, movies cater to a variety of learning styles, promoting inclusivity and effectively reaching a diverse student body. By curating films from different global regions, educators foster a rich global perspective and cultural sensitivity, enhancing students'

understanding of management practices across cultures. This exposure not only broadens student's cultural horizons but also equips them with the skills needed to navigate the complex challenges of leadership in an interconnected, global business environment. Analyzing management scenarios depicted in films sharpens students' critical thinking and decision-making abilities, empowering them to apply analytical insights to real-world situations. Movies act as a practical bridge between theoretical frameworks and their real-world applications, providing concrete examples that vividly link academic concepts to the complexities of the business landscape. Their cost-effectiveness makes them an appealing choice for institutions facing budget constraints, and the integration of technology through streaming platforms further enhances the learning experiences, particularly in online settings. Additionally, films serve as a springboard for meaningful discussions on ethics in management, encouraging students to delve into their values and develop a nuanced understanding of ethical considerations in professional roles. The inherent flexibility of using movies allows educators to tailor lesson plans to suit various topics, objectives and classroom dynamics, resulting in a responsive and engaging curriculum that keeps students invested in their learning journey.

Cultural Repercussions

Utilizing movies as a teaching tool in higher education management studies reveals a complex tapestry of social implications. On the bright side, incorporating films can significantly boost student engagement and accessibility, accommodating various learning styles while promoting cultural awareness through diverse viewpoints. This approach not only sparks critical thinking but also fosters essential leadership and teamwork skills, exposing students to ethical dilemmas that prepare them for the challenges of the real world.

On the flip side, challenges lurk in the shadows, including the potential for stereotyping, misrepresentation and an excessive focus on entertainment that could dilute academic integrity. There is a risk that reliance on technology and limited real-world applications may hinder student's holistic development. Additionally, the subjective nature of film interpretation can complicate efforts to ensure consistent learning outcomes for all students.

Challenges in Integrating Films as Teaching Tools for Management Education

When integrating movies into management education, educators encounter vital considerations such as copyright challenges, ensuring accessibility and effectively structuring discussions post-viewing. Thoughtful incorporation of films is key to transforming them into a valuable educational resource that connects theoretical knowledge with practical skills, equipping students to navigate the complexities of today's business landscape.

To maximize the benefits while minimizing potential drawbacks, educators need to carefully curate their film selections, striking a harmonious balance between entertainment value and academic rigour. Complementary strategies such as incorporating real-world case studies, practical experiences and open dialogues are essential for providing a well-rounded management education. These elements enrich movie-based learning, offering students a broader perspective on managerial scenarios. By approaching these factors with care, institutions enable educators to leverage the potential of cinematic

pedagogy. This method not only enhances the learning experience but also prepares students for the varied and ever-changing world of modern management. In this vibrant educational setting, the use of films emerges as a strategic choice, boosting engagement, promoting critical thinking and delivering a comprehensive understanding of management principles.

Conclusion

This study highlights the pivotal role of educators in shaping and enhancing student learning through the strategic use of films. This approach seeks to deepen student's understanding and skills in grasping management concepts. The findings reveal that business executive students can glean valuable insights and lessons in management from Indian Cinema. Moreover, films serve as an effective pedagogical tool facilitating experiential learning. A dedicated credit course centered around movies could be developed, providing an enriching array of educational opportunities at the higher educational level while ensuring student satisfaction.

Movies deliver a multisensory, multimodal learning experience that accommodates diverse learning preferences. They vividly illustrate complex topics, transforming abstract ideas into engaging and memorable content. Additionally, films support interdisciplinary education by weaving together multiple subjects into cohesive narratives. By encouraging students to analyze biases and diverse viewpoints, movies nurture critical thinking skills. Digital platforms further enhance accessibility, allowing educators to curate film selections tailored to specific learning objectives, thereby creating a dynamic and personalized educational atmosphere.

The innovative application of films in education is continually evolving, paving the way for a future where learning is both enlightening and enjoyable. However, this study is limited to the exploration of management courses and relies solely on existing literature available on Scopus and Google Scholar regarding the use of films as a teaching tool in this field. There are numerous other databases that could provide additional insights into novel approaches for utilizing films in management and other disciplines in India.

Future research could delve into various aspects of film pedagogy and its influence on management education. Studies might examine the long-term effects of film-based training on educators' practices and professional growth. Tracking the progress of teacher candidates who have engaged with film assignments throughout their careers could yield valuable insights. Comparative analysis could also be conducted to evaluate the effectiveness of film-based instruction against other teaching methods, highlighting the unique advantages of using films as educational resources.

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Review Article

Influence of Social Media on Adolescent Mental Health: A Gendered Perspective

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Abstract

This study attempts to understand the relationship between Social Media (SM) usage and Adolescent Mental Health (AMH) with a focus on the gendered coping mechanisms employed by adolescents to mitigate the negative impacts of excessive digital engagement. The objective is to examine the literature and evidence available as to how adolescent boys and girls develop distinct strategies to manage SM addiction and its associated stressors. Using a systematic literature review and thematic analysis of empirical studies, this research identifies key patterns in coping mechanisms and support systems. Findings indicate that adolescent boys predominantly adopt problem-focused strategies, such as seeking solutions or engaging in physical activities, while girls tend toward emotion-focused coping, including seeking emotional support and self-soothing practices. The study also highlights the influence of peer and family networks in shaping coping behaviours. However, a critical gap persists in empirical research concerning adolescents' perceptions of SM and how these coping strategies evolve over time and across diverse socio-economic and cultural contexts. The study emphasizes the need for longitudinal, culturally sensitive research to deepen our understanding of these dynamics. It concludes by advocating for tailored, gender-responsive interventions to support mental health in adolescents in the technological age, addressing both the risks and potential aspects of SM use.

Keywords: AMH, SM Addiction, Gendered Coping Mechanisms, Peer and Family Support, Digital Well-being

Introduction

The increasing integration of digital technology into everyday life has greatly changed how individuals, especially adolescents, interact with the world around them. Social Media (SM) platforms have emerged as pivotal spaces for communication, socialization, and self-expression. However, concerns regarding the potential negative effects of these platforms, particularly on mental health, have gained significant interest from researchers, academicians, and psychosocial professionals. Among the most vulnerable groups to the adverse effects of SM are adolescents, who are still undergoing crucial developmental stages in their psychological and social lives (Valkenburg & Peter, 2009). Adolescence is a time of heightened emotional and cognitive development, during which individuals are particularly sensitive to social influences. As a result, the nature and frequency of SM engagement can play a considerable role in shaping adolescents' mental well-being. Previous studies have

highlighted the potential links between excessive SM use and mental health issues such as anxiety, depression, low self-esteem, and sleep disturbances (Twenge et al., 2018). While these effects have been widely documented, less notice has been taken of the fact that how gender influences the nature and extent of these impacts. Gender plays a crucial role in influencing how adolescents engage with SM and how they experience its effects. For example, research has shown that females are more inclined to use SM for social comparison and emotional support, which can lead to heightened feelings of mental unease and dejection. In contrast, males may be more prone to using SM for gaming or competitive activities, which can lead to issues such as internet addiction or issues related to body image (Valkenburg & Peter, 2009). These gender-specific patterns of engagement could result in different mental health outcomes, making it imperative to explore these variations in depth.

Objectives

This paper aims to understand gender-specific aspects of SM addiction and its impact on the mental health of adolescents. While analyzing usage patterns, psychological effects, coping strategies, and support systems, the study seeks to understand how SM addiction manifests differently in males and females, influencing their mental well-being. Through this exploration, the study intends to inform the development of targeted strategies and policies that can promote positive mental health in adolescents navigating the digital landscape.

Method

This study adopted a systematic literature review approach to examine the psychological effects of social media use on adolescents, with a focus on gendered coping mechanisms and support systems. The review followed PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines that ensured a structured and transparent methodology. A comprehensive search was conducted across five academic databases—PubMed, SAGE, ScienceDirect, Cureus-Springer, and Google Scholar—using predefined keywords, including "Adolescent Mental Health," "Social Media Addiction," "Gendered Coping Mechanisms," "Peer and Family Support," and "Digital Well-being." Boolean operators (AND, OR, NOT) were employed to refine search results and ensure the inclusion of peer-reviewed journal articles and reports published post-2000, a period marked by the rapid expansion of SM platforms. The initial search yielded relevant studies for the period 2000 onwards, which were then screened for eligibility based on relevance to adolescent psychological well-being. Studies were filtered using inclusion and exclusion criteria, focusing on those that explicitly examined the impact of SM on mental health dimensions such as anxiety, depression, self-esteem, and addiction. Following a two-stage screening process (title/abstract screening and full-text review), 34 studies were selected for thematic analysis. Thematic synthesis was employed to analyze and categorize findings, identifying recurring themes and patterns in how adolescents experience and cope with the psychological effects of SM use. Particular attention was given to gender-specific coping mechanisms and the influence of peer and family support systems in moderating negative psychological outcomes. This review not only synthesizes existing literature but also identifies key research gaps, providing recommendations for future

studies and intervention strategies aimed at mitigating the adverse effects of SM on adolescent mental health.

Understanding SM and Gender

SM has become an inescapable and integral part of contemporary life, particularly for adolescents, reshaping how they interact, communicate, and perceive themselves in a digital world. What began as a simple form of online communication has evolved into a global phenomenon, connecting billions of users across diverse platforms and offering unprecedented opportunities for self-expression, social interaction, and access to information (Best et al., 2014). For adolescents navigating the often tumultuous journey of identity formation, SM serves as both a playground and a stage for exploring their selves, connecting with others, and discovering new facets of their identity (Cataldo et al., 2020). Through SM, adolescents can engage with peers, share experiences, and participate in online communities centered around common interests and values (Best et al., 2014). While SM offers numerous benefits, it also presents significant challenges, particularly concerning AMH. Research has consistently highlighted the growing concerns surrounding the negative psychological effects of excessive SM use, including anxiety, depression, diminished self-esteem, and body image issues (Keles et al., 2020; Schønning et al., 2020). The constant exposure to idealized depictions of life—be it through meticulously curated posts or filtered photos—can exacerbate feelings of inadequacy, leading to unhealthy comparisons, particularly for adolescents who are shaping their self-concept and identity (Cataldo et al., 2020). As they seek validation and approval from their online peers, adolescents may feel disconnected from their true selves, heightening their vulnerability to mental health issues. In addition to these psychological consequences, SM exposes adolescents to a range of risks, including cyberbullying, online harassment, and exposure to harmful or inappropriate content (Odgers & Jensen, 2020; Popat & Tarrant, 2023). The relative anonymity and distance offered by online platforms create an environment where individuals may behave in ways they would not in face-to-face interactions, leading to heightened vulnerability and distress. For adolescents, these online behaviours can take a toll on their mental well-being, further complicating their ability to navigate the challenges of growing up in a hyper-connected digital world (Odgers & Jensen, 2020). Despite these significant concerns, SM remains an inseparable part of adolescent life, with platforms such as YouTube, TikTok, Instagram, and Snapchat dominating the digital landscape (Vogels & Gelles-Watnick, 2023). The prevalent use of SM-tools in adolescents underscores the need for a rigorous inquiry into its effects on their mental health, particularly through a gendered lens. Gender differences in SM use and its psychological impact are evident, as different genders engage with digital platforms in different ways, influenced by societal expectations and cultural norms, there is an urgent need for research that examines how gender shapes the nature of SM use and its corresponding mental health outcomes (Richards et al., 2015)

In India, where SM usage has surged in recent years, the mental health implications for adolescents are of particular concern. With over 448 million SM users as of 2021, India ranks second globally in terms of digital engagement, making its youth highly susceptible to both the positive and negative effects of SM (Gupta et al., 2022). Despite the increasing penetration of digital platforms, gender disparities in SM usage persist, with men often being

more active on SM than women. This disparity can contribute to women's under-representation in digital spaces, potentially exacerbating existing gender inequalities in the form of access to opportunities and resources. Understanding the intersection of SM use, gender, and AMH in the Indian context is crucial for crafting more effective and practical strategies that deal with the distinctive challenges faced by young people, especially adolescent girls. The influence of SM on the adolescent mental landscape is multifaceted and complex. While it offers significant opportunities for connectivity and self-expression, it also exposes adolescents to a variety of risks and challenges. SM's influence on mental health and well-being is not the same and uniform; it is shaped by how individuals engage with digital platforms and how gender differences mediate this engagement. The following sections of this paper delve into the major themes related to SM use and mental health, with a specific focus on gendered perspectives. Through a rich literature review, we aim to better understand these dynamics and provide recommendations for interventions that can be critical to lessen the adverse effects of SM on the mental health of adolescents.

The intersection of gender and SM tool's use has been the subject of growing academic interest. Gender-specific differences in SM engagement are not only impacted by individual preferences but also by overarching cultural and societal factors. For instance, studies have demonstrated that adolescent girls tend to be more focused on relational and emotional aspects of SM, using it as a means of social comparison and seeking validation (Herring & Kapidzic, 2015). This tendency can increase the feelings of inadequacy and anxiety, as young girls often compare their lives and appearances to the curated, idealized images of others online. The constant exposure to these unrealistic representations can significantly contribute to the development of body discontent and depression among adolescent females. On the other hand, adolescent boys may engage with SM in a more performance-driven way, focusing on self-presentation, gaming, and achievement-based activities (Khalaf et al., 2023). These behaviours can foster competitiveness and sometimes contribute to feelings of inadequacy when they fail to meet the standards set by their peers or the online community. Moreover, excessive use of gaming and other interactive forms of media can lead to issues like addiction, reduced face-to-face interactions, and neglect of other areas of life, further exacerbating mental health problems (Popat & Tarrant, 2023). Understanding these gendered experiences of SM use is essential for tackling the mental health concerns of adolescents in the technological age.

Analysis and Major Themes

The major themes discussed in this section emerged through a meticulous thematic analysis of the literature, guided by an objective to study the nuanced relationship between the usage of SM technologies and the mental health of adolescents. The thematic analysis, as a qualitative method, involves identifying, organizing, and interpreting patterns within data. For this study, a structured, iterative approach was employed: first, a comprehensive review of relevant studies was conducted, followed by coding and categorization of key ideas. This process revealed significant patterns that coalesced into distinct themes reflecting social technological tools' impact on younger populations. Central to the findings is the paradoxical nature of SM—simultaneously a source of connection and a potential trigger for psychological distress. The themes

also illuminate how gender influences coping strategies, with adolescent boys and girls adopting distinct approaches to tackle the stressors connected with digital engagement. Moreover, the importance of social support systems, both virtual and offline, became evident as a critical factor in lessening adverse outcomes. These themes not only capture the intricacies of adolescents' engagement with SM technologies but also offer insights into potential interventions that can foster healthier digital habits. Each of these themes is discussed in detail in the following sections, offering a comprehensive knowledge of how adolescents manage the intricate digital terrain and its impact on their well-being.

1. Gendered Patterns of SM Use

The innovations of SM have basically changed the way individuals interact with the world, providing new avenues for interaction, communication, and self-expression. This digital shift is particularly pronounced among adolescents, a group that has become deeply integrated into the SM landscape. Adolescence is a crucial developmental stage characterized by significant physical, cognitive, and social changes during which individuals increasingly seek autonomy, explore their identities, and negotiate their social roles (Cataldo et al., 2020; Gross, 2004). As adolescents navigate these developmental milestones, SM serves as both a platform for experimentation and a tool for exploring their social environments. Gender has emerged as a key factor influencing adolescents' engagement with SM, shaping not only the frequency of use but also the patterns of interaction and the content consumed. While both males and females engage with SM in similar quantities, the nature and purpose of their use differ considerably.

Research shows that adolescent females, in particular, are more active on SM platforms than their male counterparts. They tend to check their accounts multiple times a day, often allocating substantial amounts of time to engage with content, interact with peers, and maintain social connections (Keles et al., 2020; Schonning et al., 2020). This pattern is partially explained by the role of SM in the lives of adolescent girls, where it serves as a primary space for social validation, emotional support, and relationship maintenance (Keleş et al., 2020; Pujazon-Zazik & Park, 2010). In contrast, adolescent boys typically use SM in a more passive, goal-oriented manner. Rather than engaging in ongoing social interactions, they mostly use SM tools for particular interests, such as accessing news, gaming content, or engaging in informational exchanges. This distinction highlights a key gender divide in SM usage: girls tend to prioritize social engagement, while boys are more focused on information consumption and entertainment. The gendered differences in SM use are further reflected in the content shared and the nature of interactions. Adolescent females are more likely to engage in self-disclosure, sharing personal thoughts, feelings, and experiences on these platforms (Pujazon-Zazik & Park, 2010; Weiser, 2000). This openness is often linked to their desire for emotional connection and support from their peers. In contrast, adolescent males are more inclined to focus on content that aligns with their interests, such as sports, gaming, and competitive interactions. These gendered patterns suggest that the motivations behind SM use are shaped not only by personal preferences but also by broader cultural expectations and social norms (Herring & Kapidzic, 2015). Moreover, the psychological impact of SM is experienced differently by adolescent boys and girls. Girls are particularly vulnerable to the negative effects of SM,

including body image issues, anxiety, and cyberbullying, which often arise from exposure to idealized beauty standards and the pressure to conform to societal expectations of appearance (Kelly et al., 2018; Twenge & Martin, 2020). These concerns can exacerbate feelings of insufficiency and lead to challenges vis-a-vis mental health.

Boys, on the other hand, may experience issues related to excessive gaming, online violence, and exposure to unsafe content, which can also contribute to negative psychological outcomes. The types of SM platforms preferred by adolescents further underscore these gendered differences. Girls are drawn to visually oriented platforms such as Instagram and Snapchat, which emphasize sharing images, videos, and personal moments to create a curated online identity. These platforms prioritize social validation through positive feedback, which includes likes, comments, and shares, reinforcing the importance of social feedback and interaction. Boys, however, tend to favour platforms like YouTube and gaming forums, where content creation and participation in gaming communities are more prevalent. This distinction highlights how gender influences the ways adolescents navigate digital spaces and engage with content that aligns with their interests and identities (Anderson & Jiang, 2018; Spies Shapiro & Margolin, 2014). Privacy is another key area where gender differences emerge. Adolescent females are more likely to be concerned with protecting their online image and regulating their privacy settings, ensuring that their content is visible only to selected individuals (Herring & Kapidzic, 2015). This careful curation of their digital presence reflects a desire to maintain control over their self-representation and manage how others perceive them online. In contrast, adolescent boys tend to be less concerned with privacy settings, often sharing content more freely and without considering the long-term consequences of their online actions (Popat & Tarrant, 2023). This discrepancy suggests that boys may be less aware of or less concerned with the potential risks of online exposure, which can have implications for their digital safety and security. Both genders, however, experience peer pressure on SM, though the nature of this pressure varies. Girls are more susceptible to comparisons with online beauty standards, which can lead to body dissatisfaction and anxiety about their physical appearance (Barker, 2009; Twenge & Martin, 2020). On the other hand, adolescent boys may feel more influenced by peer pressure related to gaming preferences, technical interests, or competitive behaviour in online environments (Booker et al., 2018; Pujazon-Zazik & Park, 2010). These gendered experiences of peer pressure demonstrate how SM acts as a space where adolescents not only seek connection but also navigate societal expectations and group dynamics.

2. Gender Differential and SM Impact

The theme discusses the varying psychological consequences of SM tools use for adolescent of all genders, with a emphasis o mental health aspects like anxiety, despair, and self-esteem. It is divided into three sub-themes: Psychological Impact, which discusses how SM addiction contributes to negative mental health in the form of anxiety, depression, and identity struggles, with girls being more vulnerable; Social Comparison and Self-Esteem, which examines how adolescents' inclination to compare themselves to other users on SM platforms negatively affects their self-worth, with girls being more affected by appearance-related comparisons; and Cyberbullying and Harassment, which highlights the

gender differences in experiencing and responding to online bullying, with girls being more likely to be victims and suffering greater psychological distress. The theme collectively emphasizes the necessity for gender-sensitive strategies to address the unique impacts of SM on mental health of adolescents.

(a) Psychological Impact

The psychological consequences of SM addiction on adolescents are concerning, with excessive usage linked to anxiety, sadness, low self-confidence, identity issues, and poor sleep quality. Research suggests that girls may be more vulnerable to these negative impacts, particularly in terms of cyberbullying and mental health problems (Keleş et al., 2020). Popat and Tarrant (2023) systematic review reveals a connection between adolescent SM use and psychological issues such as depression, anxiety, self-esteem struggles, and body image concerns. Further studies confirm that SM addiction exacerbates feelings of isolation and depression in adolescents (Naslund et al., 2020). Research by Odgers and Jensen (2020) underscores the harmful impact of SM on self-esteem and identity, especially through constant comparisons to others and exposure to unattainable beauty standards. This finding aligns with the (Twenge et al., 2018) longitudinal study, which links SM use to heightened anxiety levels, particularly due to pressures to maintain a curated image. Also, the research highlights that disproportionate SM use is correlated with insomnia, negatively affecting mental health. Gender differences in SM's psychological impact are significant, with adolescent girls experiencing greater distress compared to boys, especially concerning body image and mental health (Bergagna & Tartaglia, 2018). Parents' concerns about SM's harmful effects on their children's well-being are valid, as adolescents often encounter harmful content and engage in excessive use, amplifying their susceptibility to mental health issues (O'Keeffe & Clarke-Pearson, 2011). Moreover, the surge in SM use among Indian young populations has significant mental health implications, particularly for young girls. Regular exposure to idealized online personas and impractical beauty values can lead to increased feelings of insufficiency, body displeasure, and despair. Gender-specific differences in SM engagement, with adolescent girls focusing more on relational and emotional aspects, contribute to heightened vulnerability to adverse psychological impacts such as unease, low self-confidence, and identity issues. Also, excessive SM use is linked to insomnia and exacerbated feelings of isolation, further compromising AMH. The gender disparities in the impact of SM on well-being underscore the need for tailored interventions and increased awareness among parents, teachers, and policy stakeholders to address this pressing complex issue of younger populations.

(b) Social Comparison and Self-Esteem

SM addiction exacerbates adolescents' tendency to engage in comparison behaviour, negatively affecting self-esteem. SM platforms provide adolescents with opportunities to compare themselves to peers, celebrities, and influencers, particularly in

terms of appearance, lifestyle, and achievements (Keles et al., 2020). Studies by (Appel, Gerlach, & Crusius, 2016) show that passive SM use, such as viewing content without engaging, can increase feelings of inadequacy and envy, which in turn heightens depression risk. Research by Popat and Tarrant (2023) indicates that adolescent girls are more likely to experience detrimental effects of social comparison on their self-esteem. Long-term impacts include heightened feelings of inadequacy and a sense of social disconnection (Ardiana & Tumanggor, 2020; Schønning et al., 2020). The extensive use of digital platforms has made it easier for adolescents to engage in comparison behaviour, which often leads to feelings of inferiority and anxiety. These comparisons are not limited to appearance but extend to achievements, social status, and lifestyles, contributing to a complex web of psychological impacts (Vogel et al., 2015). Gender differences are notable, with adolescent girls being particularly vulnerable to appearance-related comparisons, leading to increased dissatisfaction with their physical appearance. In contrast, adolescent boys tend to be more affected by comparisons related to achievements and social status (Mingoia et al., 2017; Nesi & Prinstein, 2015). Understanding these gender-based differences is crucial for devising specific interventions to address the mental health implications of SM use. Addressing the negative psychological consequences of SM obsession among adolescents, particularly the disparate influence on girls, is essential for promoting their overall well-being and healthy development.

(c) Cyberbullying and Harassment

Cyberbullying is a major concern in the digital era, with both boys and girls experiencing its harmful effects. The anonymity and broad reach of online platforms amplify the psychological impact of cyberbullying, leading to feelings of isolation, anxiety, and depression (Schønning et al., 2020). Research shows that girls mostly fall into the trap and become victims of cyberbullying compared to boys, which suggests that gender differences play a paramount role in the experience and influence of online harassment. Female victims of cyberbullying tend to experience greater psychological distress than their male counterparts (Betts et al., 2020; Kowalski et al., 2014; Selkie et al., 2016). Gender norms also influence how adolescents respond to cyberbullying: girls generally defend victims, while boys mainly prefer silence. Also, females are more likely to engage in relational aggression in online spaces, whereas boys may exhibit more physical aggression (Snell & Englander, 2010). These gender differences underscore the need for gender-sensitive strategies in preventing and addressing cyberbullying. Moreover, engaging in cyberbullying has been linked to increased depressive symptoms and anxiety issues, underscoring its detrimental effect on adolescent well-being (Popat & Tarrant, 2023). While some research indicates that girls are disproportionately affected by cyberbullying, other studies find no significant gender differences in the experience of cyberbullying (Navarro & Jasinski, 2013). While understanding the nuances of gender-based differences, researchers and policymakers can develop more

effective strategies to mitigate the negative consequences and empower adolescents to tackle the digital world and its technologies in a productive, healthy, safe and resilient manner.

3. Coping Mechanisms and Support Systems

The ever-present and accessible SM technologies have raised significant concerns about its influence on mental health of adolescents, particularly regarding addiction and the resulting negative effects. This review explores the various coping mechanisms employed by adolescents to manage these challenges. While much research has focused on the harmful consequences of excessive SM usage, there is limited empirical evidence on how adolescents perceive these platforms and how they use coping strategies to manage their addiction to them (Khalaf et al., 2023). Research shows that adolescent boys and girls tend to employ different coping strategies to deal with the mental and psychological effects of SM addiction. Adolescent boys are often more likely to use problem-focused coping mechanisms, which involve actively seeking solutions and trying to change the circumstances that are causing stress or discomfort. For instance, they may look for answers to their concerns or take actions aimed at reducing the influence of SM tools on their self-concept and well-being. In contrast, adolescent girls typically use emotion-focused coping strategies, such as seeking emotional support from close friends or family members, or engaging in self-soothing activities like hobbies, exercise, or relaxation techniques (Mahon & Hevey, 2021; Khalaf et al., 2023). Further distinctions emerge when it comes to how each gender diversifies their coping methods. Boys might opt for distractions such as physical activities, sports, or hobbies to alleviate the psychological stress of SM usage. In contrast, girls may turn to discussing their worries with others, seeking advice, or sharing their experiences in online or offline spaces as a means of emotional release (O'Reilly et al., 2019). The importance of gender-specific support networks also plays a critical role in adolescents' coping mechanisms. Research indicates that adolescent boys tend to seek assistance from their male peer groups, whereas girls are more likely to find support from female friends or family members. These gendered differences highlight the need for tailored support systems that can help adolescents manage SM addiction in a way that is sensitive to their unique needs and coping styles. For instance, therapeutic interventions and support programs can benefit from acknowledging these gendered approaches, ensuring that they provide the right type of emotional, social, or behavioural guidance to adolescents. Recognizing and addressing the different ways boys and girls cope with SM addiction is crucial for developing effective and practical interventions, strategies and support systems. By doing so, we can better equip adolescents to navigate the complexities of SM while protecting their mental health.

Discussion

This review, while critically examining the intricate relationship between mental health and SM usage, also focused on the coping mechanisms adolescents employ to manage the potentially addictive and adverse effects of SM technologies. The findings highlight several important gaps and complexities that require further exploration. The influence of SM on the psychosocial health of adolescents is multifaceted, and understanding how adolescents cope with its challenges requires a nuanced and context-sensitive approach. One of the most

striking observations from the literature is the clear gendered divergence in coping mechanisms. Adolescent boys tend to favour problem-focused coping strategies, such as engaging in physical activities or seeking to resolve the stressful situations that arise from SM interactions. In contrast, adolescent girls generally adopt psycho-social and emotion-focused coping mechanisms, seeking emotional support from their social circles or engaging in reflective, self-soothing activities. These findings suggest that coping mechanisms are not only shaped by individual preferences but are also deeply embedded in gender norms and expectations. Boys' tendency to engage in distraction through physical activities and girls' inclination toward emotional support underscores the necessity of considering gendered approaches when designing interventions for adolescents struggling with SM addiction. However, while gender differences were found to be significant, the intersectionality of several other factors and forces, such as age, socioeconomic status, and cultural context, also warrants further attention. It is crucial to specify that these coping patterns are not universal and may vary across different cultural and socio-economic contexts. The limitations of the existing studies in accounting for these variables should be addressed in future research. Moreover, the importance of support systems, particularly peer groups, is a recurring theme across the literature. Adolescent boys often rely on male friends, while girls seek comfort from female peers or family members. This gender-specific pattern in support-seeking behaviour highlights the role that social networks play in AMH. Peer relationships are crucial in offering both emotional validation and practical advice. However, these findings also point to a potentially under-explored area: the role of family support systems and the influence of adult figures such as parents, teachers, and mental health professionals in shaping adolescents' coping strategies. Future studies must go beyond peer-based support to consider how parental involvement and guidance can help adolescents develop more adaptive coping mechanisms and improve their mental health outcomes. Despite the growing research and evidence, several methodological gaps remain. Most studies are cross-sectional, which limits our understanding of the long-term effects of SM usage on the mental health of adolescents. The short-term focus of existing research makes it difficult to discern whether the coping strategies adolescents develop in response to SM addiction are sustainable over time, or if they evolve as adolescents age. This lack of longitudinal research is a significant limitation and calls for the need for studies that track the same cohort of adolescents over an extended period, to better understand the lasting consequences of SM use on mental health. Moreover, much of the existing evidence fails to address the nuances of different SM platforms. While some studies examine the general impacts of SM, few provide insights into the specific features of platforms—such as Instagram, TikTok, or Facebook—and how these features might influence adolescents differently. The nature of SM, with its varying emphasis on image-sharing, videos, or live interactions, likely shapes adolescents' coping mechanisms in unique ways. It also emphasized that more platform-specific research be done to understand the differential impact of various types of SM on AMH and coping strategies. Cultural factors also play a critical role in shaping how adolescents engage, experience and cope with SM addiction. Much of the existing literature, particularly from Western contexts, fails to account for the diverse cultural dynamics that may influence coping mechanisms. In non-Western societies, where community structures, family roles, and societal

expectations differ, adolescents may adopt different coping strategies or rely more heavily on familial or community support. Cultural sensitivity in research is essential to understanding these differences and developing interventions that are not only effective but also culturally appropriate.

Critical Takeaways

Adolescent boys and girls employ distinct coping mechanisms, with boys tending to use problem-focused strategies like physical activity, while girls are more inclined toward emotion-focused coping, such as seeking emotional support. Interventions must, therefore, be gender-sensitive to effectively address SM addiction in adolescents. Further, peer groups play a central role in adolescents' coping processes, but the support from family members—particularly parents and educators—also needs greater emphasis. Future research should explore how adult involvement can enhance adolescents' ability to cope with SM-related stress. A significant gap in the literature is the dearth of longitudinal studies that study the long-term effects of SM use on the mental health of adolescents and how coping strategies evolve. Understanding these long-term effects is critical for designing sustained interventions. Future studies should focus on the specific nature of different SM platforms and how they affect adolescents in unique ways. The focus should shift from general studies to platform-specific ones to understand the diverse impact of digital spaces on AMH. Similarly, the role of culture and context in shaping adolescents' experiences with SM addiction must be prioritized in future research. Studies should include diverse cultural perspectives to better understand how SM affects adolescents in various parts of the world. This review emphasizes the interwoven interplay between SM use and the psychosocial health of adolescents, underscoring the need for a multi-dimensional approach to studying coping mechanisms and support systems. While current research provides valuable insights into gendered coping strategies, peer support, and the need for more longitudinal studies, significant gaps remain in understanding the broader cultural, familial, and platform-specific factors that influence adolescent responses to SM. As digital platforms continue to evolve and get complicated while becoming an increasingly pervasive part of adolescents' lives, addressing these gaps will be crucial in developing more effective, tailored interventions to support mental health of younger populations in the complex digital age. Future research must adopt a more interdisciplinary, culturally aware, and long-term perspective to provide a clearer picture of how adolescents navigate and tackle the adverse aspects and challenges of SM technologies and its impact on their mental well-being of adolescents.

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General Article

Artificial Intelligence and the Future of Education

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Abstract

This article deals with artificial intelligence and its impact on education. To start with, the basics of artificial intelligence (AI) are discussed with a special focus on what AI is, how it is related to machine learning and deep learning and how an AI system works with special reference to the importance of data and algorithms. The applications of AI in education, such as personalized learning, personalized curriculum, AI teachers, smart content, smart classrooms, intelligent tutoring systems, etc., are also discussed. The various challenges associated with successfully implementing AI in the education sector are also discussed briefly. Finally, how AI could also be helpful in the conduct of research is described.

Keywords: Artificial intelligence, personalized learning, customized curriculum, AI teacher, intelligent grading systems, gamification

Introduction

Education is the process of enabling learning- be it knowledge (cognitive domain), physical skills (psychomotor domain), attitudes, etc. (affective domain). Learning helps achieve the ultimate goals of education, i.e. to produce a competent professional, a responsible citizen, and a good human being. Over the years, the methods of imparting education have changed significantly with the growth of technological developments around the world. Information and Communication Technology (ICT), for example, has revolutionized the way education is imparted with an increasing focus on online education, e-learning, MOOCs, blended learning, online examinations, etc. Since technology is a journey and not a destination, in this chain of technological advancements, artificial intelligence is another disruptive technology that is totally going to transform the way education is imparted at present. NEP-2020 (NEP document) also acknowledges the significant potential of AI and advocates for its incorporation into the education system to enhance efficiency, effectiveness, and accessibility. The Internet of Things (IoT) and artificial intelligence (AI) have already been incorporated into the curriculum for classes VI through X by the Central Board of Secondary Education. Given the increasing importance of AI in education, even India's first AI University has now started functioning in Karjat, near Mumbai, from 2023.

What is this AI, how it works and how it is going to transform the education sector in the country with reference to curriculum designing, teaching-learning, assessment, research and the roles of the teachers are the questions that will be addressed in this article.

What is artificial intelligence?

Human intelligence is the ability to

understand, learn, think, or solve new or complex situations. Artificial Intelligence (AI), the intelligence of machines, is nothing but simulating human intelligence into computers so that they can think and act like humans. It is worth noting that, unlike human intelligence, which uses the brain, memory and intelligence, artificial intelligence is based on information provided by humans. This is the biggest difference between human intelligence and artificial intelligence. Some other differences between artificial intelligence and human intelligence are that AI processes information faster and more accurately adapts to changes, and is goal-oriented. AI machines are capable of perceiving, thinking, understanding language, recognizing sounds and images, learning and problem solving, etc. AI, which is a branch of computer science, is not a single technology but actually encompasses several technologies that work together to enable devices or machines to function with an intelligence that is as human-like as possible. Some common examples of AI in our day-to-day life are Google Maps, google search engine, spam filters, automatic language translation, Wolfram Alpha answer engine, Chat GPT, and intelligent digital personal assistants like Siri, Cortana, Alexa, etc. All of these are driven by AI. The most innovative developments based on artificial intelligence include recognition of the face and voice, speech recognition, foreign language translation and machine vision, driverless cars, manufacturing robots, chatbots, virtual workers, etc.

Artificial Intelligence, Machine Learning, and Deep Learning

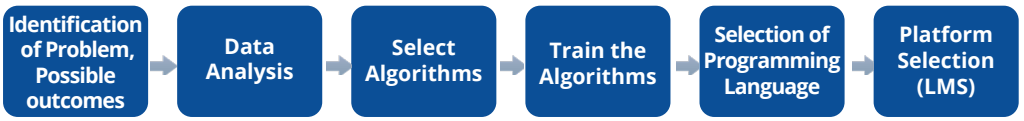
In the context of artificial intelligence, the terms machine learning and deep learning are often used interchangeably with artificial intelligence. While they are related, they are certainly not synonymous. Machine learning is a subset of artificial intelligence that aims to enable computers to perform various tasks without explicit instructions (Bell & Blackwell,2022; Chang et al.,2018). Machine learning also refers to the development of computers that can access different types of data and use it to learn on their own. Conversely, deep learning is a branch of machine learning that is based on neural networks (Fan et al.,2021). Neurons are like little messengers in our brains that send and receive messages throughout our body, allowing us to think, feel, move, and interact with the world around us. Artificial neural networks on which deep learning is based mimic the functioning of the human brain. The way data is delivered to the machine is the main distinction between machine learning and deep learning. While deep learning uses multilayer neural networks, machine learning methods usually require organised data.

How does artificial intelligence work?

To perform various tasks with minimal human intervention, AI systems are designed to generate information and make decisions based on it. A knowledge base is a database containing facts, theories, and rules that intelligent machines can use to make decisions. Artificial intelligence starts with a lot of information from different sources when building a knowledge base. This information includes speech, text, images, content and results and is the life of information. In order to process and analyse enormous volumes of data, find patterns, and make predictions or judgements based on those patterns, artificial intelligence systems use algorithms and computational models (see figure). Therefore, data is the fuel that drives AI innovation and enables AI systems to mimic human intelligence. Whether in education, healthcare, finance or entertainment, data-driven

AI is transforming every industry and shaping the future. Without data, AI won't have the foundation it needs to work effectively. It is important to note that the quality of information is crucial in the field of artificial intelligence. AI systems pick up knowledge from the data they are given, and if this data is biased or lacks diversity, it can result in biased decisions and conclusions. The adage "garbage in, garbage out" applies here; poor or biased data can make AI models ineffective, leading to biased decisions and inaccurate predictions.

Figure-1: Steps in the Design of an AI System



Artificial Intelligence in Education

Artificial intelligence has the potential to transform the way education is delivered. The power of AI is so great that it is going to redefine 21st century education. Some of the changes the world is going to witness in the education sector due to the introduction of AI are:

(i) Personalized learning: In the field of education, the concept of personalized or individualized learning is becoming increasingly popular and is recognized as the future of education. The traditional teacher-centric method of teaching, which is linear and like a 'one size fits all approach' to education, is slowly losing favour among students and educationists as this is not able to meet student's academic needs or fuel a passion for learning. An educational strategy known as "individualised learning" adjusts lessons to each student's unique requirements, abilities, and interests. Each student is unique, meaning they have different needs, understandings, learning abilities, and knowledge. Personalized learning focuses on transforming classroom instruction by customizing tasks, instructions, content, and assessments to align with each student's unique needs and abilities(Bakhshi & Rarh, 2023) AI gathers and examines student performance data to provide educators with information to make informed decisions, identify gaps, and improve teaching strategies.

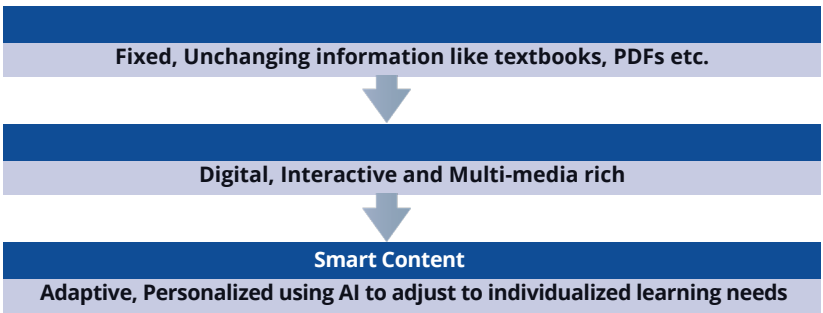
(ii) Customized curriculum: The first step in personalized learning is developing a personalized or individualized curriculum. AI can assist in curriculum development with the ability to tailor curriculum to the specific needs of each student. AI algorithms can develop personalized learning paths by analyzing student data, including learning preferences, strengths and weaknesses. Every student then can receive a study plan based on what they know and how they learn best. Personalized learning plans are a unique benefit that AI provides to every student.

(iii) Artificial intelligence teacher: In the light of personalized curriculum, the next step toward personalized learning is personalized support that AI teachers can provide to each student. Visualize a classroom

where every student has a virtual AI mentor who is always ready to help. These intelligent learning systems use AI algorithms to analyze the strengths and weaknesses of individual students and personalize learning materials accordingly. Whether it is providing more explanation, more practice or more resources, AI tutors can provide personalized support to ensure that students learn at their own pace and reach their full potential.

(iv) **Smart content:** Smart content refers to personalized content that is customized for each user, taking into account demographics, behaviour, and engagement. Smart content can be activities, quizzes, lesson plans, etc. This content is dynamically updated based on who is viewing it. It is also called dynamic content, as opposed to the multimedia-rich static content that is the basis of e-learning and MOOCs. Smart content always produces better results than static content and is very useful in the context of personalized learning (Grace et al.,2020; Silvana & Fajar,2016). AI can help you create high-quality training materials that meet your learning goals, including interactive videos, quizzes, and simulations, and recommend resources appropriate for different needs.

Figure-2: Transition from Static Content to Smart Content


Fixed, Unchanging information like textbooks, PDFs etc.
Digital, Interactive and Multi-media rich
Smart Content
Adaptive, Personalized using AI to adjust to individualized learning needs

(v) **Smart Classroom:** AI-based virtual classroom or smart classroom is a solution that bridges the gap between physical and remote learning. These virtual classrooms can foster collaboration among students by allowing them to work on group projects, engage in interactive discussions, and share ideas and feedback. This encourages collaboration, communication, and a sense of community among students. In smart classrooms, AI collects and analyzes large amounts of data about student performance, engagement, and learning patterns. AI analyzes student data to provide personalized guidance, adaptive feedback and interventions to meet individual learning needs and improve performance. AI-powered virtual classrooms enable teachers to monitor student progress and pinpoint areas of difficulty, facilitating targeted support and resources to assist students in overcoming challenges and attaining academic success. By analyzing large amounts of data faster and more accurately, AI can help

you derive unique insights from data that would otherwise take weeks or months to process manually.

(vi) **Intelligent Assessment System:** Assessment and evaluation are key components of education systems, but they are time-consuming and inclined to human error. AI can easily simplify the assessment process and make it more accurate and efficient. Artificial intelligence tools like Gradescope, ZipGrade, and ClassPoint AI can be of excessive help in this regard. AI-based grading systems can analyze and grade student assignments, essays, and even open-ended questions. Using machine learning algorithms, these machines can identify patterns and provide students with consistent and reliable advice. This allows teachers to focus on personal instruction and support rather than spending too much time on grading.

(vii) **Artificial intelligence-based supervision:** Maintaining academic integrity during evaluation has grown in importance as online and remote learning develop. AI-based proctoring helps make online exam monitoring more efficient and scalable. AI can use facial recognition, eye tracking, and audio analytics to detect distrustful behavior and perceive plagiarism or AI-generated content to improve educational integrity.

(viii) **Intelligent student support system:** AI-based student support systems can provide students with 24/7 support to resolve issues and provide timely assistance. By providing immediate support, AI-based student support systems promote student success and ease the burden on teachers. For example, chatbots can be integrated into educational platforms to answer common questions, advise on administrative procedures, and provide academic advice. These chatbots use natural language processing to understand student questions and respond with relevant information.

(ix) **Natural Language Processing (NLP):** Enabling machines to comprehend and interpret spoken and written language similarly to humans is the main goal of this branch of artificial intelligence. NLP integrates computer science, machine learning, deep learning, and linguistics to enable computers to analyse unstructured text or speech data and extract pertinent information from it (Khurana et al.,2023; Collobert et al,2011). It is a tool used to help machines understand, analyse, process and interpret human speech. NLP plays an important role in many applications, such as chatbots, virtual assistants, speech-to-text, machine translation, auto-correction, etc. NLP systems can convert text to speech and speech to text. The steps for this conversion are: (i) People talk to machines. (ii) The machine captures the sound. (iii) Audio is converted to text. (iv) text data processing; (v) the data is converted into sound; and finally (vi) the machine responds to the human by playing the audio file. Predictive typing and spell check features in search engines that help you by suggesting the next

word in a sentence when you type a keyword are examples of natural language processing (NLP). As an example, ChatGPT exemplifies natural language processing technology powered by artificial intelligence, enabling chatbots to engage in conversations that mimic human interaction and beyond. Language models are adept at answering questions and supporting tasks like drafting emails, essays, and coding.

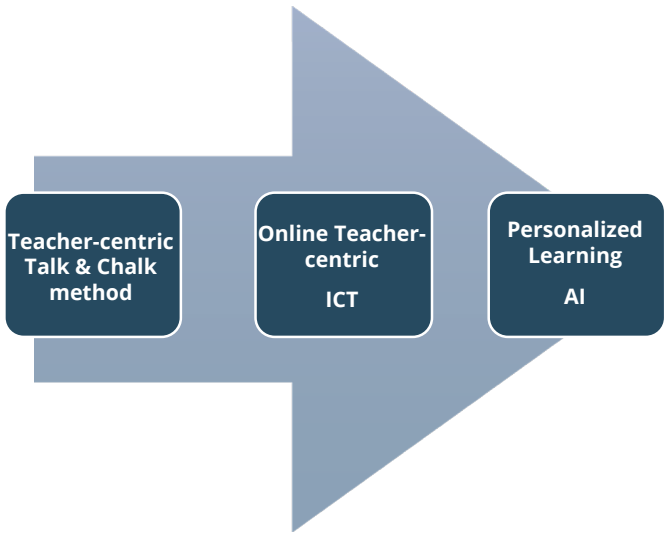
(x) **Gamification and educational games:** Gamification is based on the theory that if learning is based on game concepts such as competition, incentives, and goal achievement, students will be more engaged in their learning and achieve greater academic success. A variety of e-learning games are available for both individuals and teams. Artificial intelligence can be integrated into learning games to provide personalized challenges, track progress and adapt gameplay to individual learning styles, enabling interactive and participatory learning processes.

(xi) **Virtual laboratory:** AI can simulate experiments in virtual labs, letting students perform experiments in a safe and controlled environment. Virtual labs can provide hands-on experience in a variety of scientific fields, promoting a deeper understanding of concepts.

(xii) **Interactive simulations**: AI-based interactive simulations can help students visualize complex scientific phenomena. These simulations can be used to make abstract ideas more concrete by demonstrating concepts in physics, chemistry, biology, and other sciences.

(xiii) **Augmented Reality (AR) and Virtual Reality (VR):** By integrating AI with AR and VR technologies, immersive learning experiences in science education can be crafted. This allows students to engage with 3D models, embark on virtual tours, and interact with virtual objects, thereby deepening their grasp of intricate scientific concepts.

Figure-3: Evolution of Learning Process



Artificial Intelligence in Research

AI has become an essential part of research in various fields: right from using NLP for literature reviews to providing powerful tools and techniques to quickly analyze large data sets, discover patterns and gain insights through predictive models. Deep learning is used for image and pattern recognition tasks (Wu et al.,2011) in fields such as biology, astronomy, and medicine, where researchers must analyze and interpret complex visual data (Hu & Buehler,2023). AI speeds up the drug discovery process by analysing biological data to pinpoint potential drug candidates and forecast their effects (Jiménez-Lunaa et al.,2021; Chen et al.,2023). This approach can markedly decrease the time and cost accompanying developing new medicines compared to traditional, resource-intensive procedures such as wet laboratory testing, validation, and synthesis in drug discovery. Complex simulations and models to test hypotheses and predict outcomes can also be easily implemented using AI. AI is also used in climate modelling, satellite data analysis, and environmental monitoring. This helps researchers understand climate change (Huntingford et al.,2019; Cowls et al.,2023), predict natural disasters, and analyze the impact of human activities on ecosystems (Chen et al.,2023). For more than a decade, the authors of this manuscript have been using an AI technique called Genetic Algorithm (GA) (Goldberg,1989) in computational chemistry research, focusing on theoretical designing of low band gap electrically conducting polymers. While designing an in-silico polymer, there are several possible ways to arrange the homopolymer units to form a polymer chain having the desired physical and chemical properties. Consequently, generating polymer chains with tailor-made properties is highly challenging and requires significant computational resources. To address this issue, our research group has explored the use of metaheuristic optimization and search methods to streamline the process. GA is one such widely used technique in science and technology that has also proven to be very useful in solving optimization problems (Arora & Bakhshi,2010; Arora & Bakhshi,2011; Kapoor & Bakhshi,2013). The authors have been able to successfully calculate and predict the theoretical properties of various binary and ternary conducting polymers, donor-acceptor type copolymers and biopolymers. AI is proving to be a very useful tool in making calculations faster, more accurate and computationally less expensive.

(i) Disadvantages of AI

Despite its significant benefits, AI technology also presents numerous risks and potential dangers that warrant consideration.

(ii) Job Replacement

AI's capability to automate processes, rapidly generate content, and operate continuously may result in human job displacement. In fact, many jobs, including those that are repetitive or predictable and those that require critical thinking, critical analysis, research-based, or specialized skills, will be at risk due to AI, automation, and robotics. In this regard, traditional positions of data entry clerks, secretaries, accountants, mechanics, and machine repairmen could be replaced by experts specializing in data analytics, AI, machine learning, big data, and digital transformation.

(iii) Privacy Concerns

Data gathered and stored by AI systems might be processed without user consent or awareness and could be

accessed by unauthorized individuals in the event of a data breach.

(iv) Ethical issues

The development of AI systems often lacks transparency, inclusivity, and sustainability, potentially leading to unexplained harmful decisions by AI and negative consequences for users and businesses.

(v) Environmental costs

Deploying large-scale AI systems could necessitate substantial energy consumption for data processing, potentially leading to heightened carbon emissions and water usage.

High Cost of AI Implementation

AI requires appropriate infrastructure and resources to operate effectively and efficiently. This includes a reliable internet connection, hardware devices, software platforms, data sources, and human expertise. However, many educational institutions lack these prerequisites, which can widen the digital divide and worsen educational inequalities.

Other negative consequences of AI in education

Despite the tremendous changes that AI will bring to education, there are some negative consequences of integrating AI into education. These include (a) Lack of human interaction due to over-reliance on technology, (b) AI reduces students' reflective and critical thinking skills, negatively affecting their creativity, (c) AI may pose a threat to teachers' job security, (d) AI adoption is costly, (e) Lack of emotional intelligence, (f) Problem of accessibility and equity, and (g) Need to train teachers in the use of AI.

Conclusion

Artificial intelligence is changing the way we learn, teach, and research. With the ability to personalize learning, deliver personalized curriculum, automate various administrative tasks, deliver smart educational content, create virtual teachers and smart classrooms and more, AI will shape an exciting future for education. Nevertheless, it is crucial to confront ethical, environmental, and privacy considerations, ensuring that education remains a guiding light of opportunity and advancement in a constantly evolving world.

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Driving Factors for Learner Engagement in MOOCs: An Interpretive Structural Modeling Approach

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Abstract

The impact of technology on education has revolutionized the way we teach and learn. It has widened the scope of education, making it more accessible, efficient, and effective. With the help of technology, learners can learn through various online platforms, breaking the traditional classroom barriers. This has resulted in a global learning community connecting learners from different parts of the world. The Indian government launched an initiative called SWAYAM in August 2014, which provides Massive Open Online Courses (MOOCs) to promote equal access to quality education. These courses are gaining popularity and are easily accessible to anyone with an internet connection. SWAYAM offers courses in higher education, high school, and skill sectors. This program enables learners to earn credits recorded in their academic bank of credits (ABC) to advance their careers. Variables such as curiosity, reputation, flexibility, and intention play a crucial role in driving the other variables in the final model. The study's dependent variables include credit transfer, assistance, mentor-mentee support, job prospects, and eagerness. To create MOOC courses for learners, universities and institutes must consider important factors that are crucial in today's world.

Keywords: SWAYAM, MOOCs, ABC, ISM, Higher Education

JEL Classification: Q01, O33 & G59

Introduction

The advancements in information and communication technologies are both impressive and remarkable. The development of computer devices that are smaller, cheaper, and more readily available has brought about a revolution in the way that communication is conducted. Thanks to the availability of broadband connectivity, it is now possible to transmit information across vast distances in a matter of seconds. Tablets and smartphones have further improved this capability, making education available to students in even the most remote corners of the world. These technological advancements have paved the way for the creation of online educational content and virtual higher education institutions, including Massive Open Online Courses (MOOCs). The educational landscape has been transformed by Massive Open Online Courses (MOOCs), which have revolutionized online learning. MOOCs are different from traditional methods of learning and have a much larger audience, as they are open and free to everyone (Voss, 2013). Within a short period of time, millions of people have enrolled in a few MOOCs, making it a disruptive technology that could pose a challenge to higher education institutions (Lucas et al., 2013; Mehaffy, 2012; Yuan & Powell, 2013). Although MOOCs have gained popularity, their completion rates are significantly lower

compared to those of traditional online courses. In fact, less than 10 per cent of students who enroll in a MOOC end up completing it (Breslow et al., 2013; Ho et al., 2014; Jordan, 2014; Kolowich, 2013). Although some experts argue that completion rates may not be the most accurate measure of learning in MOOCs (Ho et al. 2014; Jordan, 2014), concerns still arise about their effectiveness (Chafkin, 2013; Marcus & Davis, 2013). MOOCs are a disruptive technology in education with a significant impact on learning and the role of educators. They offer unprecedented learning opportunities to anyone with internet access, regardless of their location, and give students access to courses from some of the most prestigious institutions around the globe. Technology-based education is rapidly gaining popularity as traditional campuses struggle to meet the diverse needs of students. Open and distance learning systems are meeting the demands of individuals and communities for flexible education delivery systems. The potential of Information and Communication Technologies (ICTs) to enhance access and equity in higher education and the education sector is significant. People enrol in MOOCs for various reasons, including curiosity and career advancement (Breslow et al., 2013). However, there has been limited research on the factors that influence MOOC completion and retention. By examining the elements that contribute to the continued use of Information Systems (IS), such as MOOCs, we can gain insights into their sustainability and viability. India's government has recently launched a New Education Policy (NEP-2020), which aims to promote the multidisciplinary development of students and holistic education. The policy seeks to provide greater flexibility in learning, especially for students in far-flung areas and enables them to choose from a wide range of courses. Such courses include skill enhancement, ability enhancement, vocational courses, and language courses, allowing students to select courses based on their interests. The policy also emphasizes industry internships, which can offer practical exposure to students from all disciplines. Additionally, it encourages research, which can help inculcate a forward-looking approach and diverse perspectives in students. These measures are expected to unlock new opportunities for students and foster their talents, ultimately contributing to the country's development. The objective of this study is to identify the driving variables that enhance an individual's intention to continue utilizing MOOCs.

Literature Review

Education is the foundation for the socio-economic, cultural, and political development of a society or country. It provides people with the necessary skills, knowledge, and information. Our lives have been significantly transformed by the "disruptive power" of the internet, which has also altered "where" and "how" we obtain information. Our ability to participate in informal education from anywhere at our convenience has improved due to access to the Internet and mobile devices (Sharples et al., 2009). This "here and now" learning has enabled flexible and convenient access to knowledge, information, and content (Carr, 2012; Hill, 2012; Lucas, 2014), regardless of location (Martin and Ertzberger, 2013). Distance learning, open universities, online learning, e-learning, and open educational resources are examples of how this convenient access has disrupted traditional modes of learning (Altbach et al., 2010; Carey, 2012; Castellano, 2014; King and Sen, 2013; Yuan et al., 2008). Massive Open Online Courses (MOOCs) are also becoming more and more popular, and some academics predict that MOOCs will significantly "unbundle" (Shirky, 2012), "undermine" (Mazoue, 2013), "destroy"

(Harden, 2013), "fragment" (Irvine et al., 2013), and replace conventional higher education models. Disruptive technologies pose a danger to higher education leaders in the current education marketplaces because they can make them change how they operate. This transformation may be so disruptive that they will lose their jobs. This "disruption" to the existing higher education model, according to Yuan and Powell (2013a, 2013b) and Mazoue (2013), is fundamentally a challenge to its pricey business strategy. Some institutions have begun to respond to this notion by adding MOOC courses into their conventional programs, for example. To offer courses, Ivy League universities like Stanford, Penn, Princeton, Harvard, MIT, and others now work with MOOC providers like Coursera, edX, and Udacity (Carr, 2012). The experimentation with MOOCs is still in its early stages, and several obvious issues need continued attention, such as proper course organization and management, venture investment, and funding to assure financial viability and recognition (Milheim, 2013). Universities offering MOOCs often require evidence that their continuing support for MOOC production aligns with current institutional strategic goals (Deng, et al., 2020). Understanding the differences in learner motivations to enrol in a course necessitates careful consideration of learner experiences within MOOCs (Moore, et al., 2022) Institutions that offer blended MOOCs should prioritise creating a good learning environment that encourages peer-to-peer learning, teamwork, idea sharing, and getting feedback from instructors and other students (Edumadze & Govender, 2024)

Research Questions

1. What are the key factors that influence learners' decision to choose specific MOOC courses?
2. What are the dependent and linking variables to remain attractive for the learners?

Research Methodology

Statistical Tool

Interpretive structural modelling (ISM) analyses complex systems, identifies their parts, and examines their interactions. It aids decision-making and may reveal the hierarchical links between Variables. It incorporates problem identification, system definition, and reachability matrix creation. The reachability digraph, a graphical depiction of the system's hierarchy, is derived from the reachability matrix. Identifying the system's drivers and dependents follows the reachability digraph. These components strongly impact others and are strongly influenced by others. Recognizing system component impact levels completes the structural model. The structural model shows the hierarchical links between system components and helps explain system dynamics and interdependencies. It helps analyse complex systems, identify drivers and relationships, and inform decision-making. It helps communicate complicated concepts and facilitate collaborative decision-making by visualizing system linkages.

Data collection

Qualitative data were acquired for the research. Information was obtained via literature study as well as current trends and patterns that the observed among the different types of Learners. Ten factors were chosen for examination, and they are listed below.

1. Curiosity to Learn
2. Reputation of platform
3. Flexibility and Access to contents
4. Intention to Updated

5. Credit Transfer
6. Eagerness to expand Knowledge
7. Certificate
8. Job Prospect
9. Assistance from University / College
10. Mentor Mentee support

Results, Analysis and Discussions

Structural self-interaction matrix

The SSIM is formulated after the identification of variables that are pertinent to the problem at hand, which can be seen in Figure 1. There exist four potential relationships among the factors, which have been assigned the following codes:

If "row" variable is leading to "column" variable = V

If the "column" variable leads to the "row" variable = A

If both the "row" and "column" variables leading to each other = X

If there is no relationship between the "row" and "column" variables = O

Figure-1: Structural Self-Interaction Matrix

Variables	1	2	3	4	5	6	7	8	9	10
Curiosity to Learn		V	V	X	X	V	V	V	V	V
Reputation of platform			V	V	V	V	V	V	O	O
Eagerness to expand Knowledge				A	O	A	V	A	V	V
Flexibility and Access to contents					A	V	V	V	O	V
Intention to Updated						V	V	V	V	V
Credit Transfer							V	V	V	V
Certificate								A	V	A
Job Prospect									A	A
Assistance from University / College										A
Mentor Mentee support										

Figure-2: Reachability Matrix

Variables	1	2	3	4	5	6	7	8	9	10	Driving Power
Curiosity to Learn	1	1	1	1	1	1	1	1	1	1	10
Reputation of platform	0	1	1	1	1	1	1	1	0	0	7
Eagerness to expand Knowledge	0	0	1	0	0	0	1	0	1	1	4
Flexibility and Access to contents	1	0	1	1	0	1	1	1	0	1	7
Intention to Updated	1	0	0	1	1	1	1	1	1	1	8
Credit Transfer	0	0	1	0	0	1	1	1	1	1	6
Certificate	0	0	0	0	0	0	1	0	1	0	2
Job Prospect	0	0	1	0	0	0	1	1	0	0	3
Assistance from University / College	0	0	0	0	0	0	0	1	1	0	2
Mentor Mentee support	0	0	0	0	0	0	1	1	1	1	4
Dependence Power	3	2	6	4	3	5	9	8	7	6	

Reachability Matrix

Figure 2 displays the assessment of the obtained RM for its transitivity. As a mathematical concept, transitivity asserts that the rows and columns of a specific matrix represent subnets, where every cell indicates the row subnet's ability to access the column subnet. Before iteration, it was discovered that the curiosity to learn holds the most significant driving power, while assistance has the least driving power. Certificates have the highest dependence power, while reputation has the lowest dependence power.

Final Reachability Matrix

The Final Reachability Matrix, depicted in Figure 3, is a tool used to evaluate the impact and interconnectivity of technology in education. It measures the driving power and dependence of each variable, which refers to the number of variables that can be used to achieve a specific objective and the number of variables that contribute to its achievement, respectively. Upon iteration, the variables with the highest driving power were found to be learning curiosity, reputation, flexibility, and intention to update, while eagerness, certification, job prospects, assistance, and mentor-mentee support exhibited the highest dependent power. This information provides insight into the connections between the variables.

Figure-3: Final Reachability Matrix

Variables	1	2	3	4	5	6	7	8	9	10	Driving Power
Curiosity to Learn	1	1	1	1	1	1	1	1	1	1	10
Reputation of platform	1*	1	1	1	1	1	1	1	1*	1*	10
Eagerness to expand Knowledge	0	0	1	0	0	0	1	1*	1	1	5
Flexibility and Access to contents	1	1*	1	1	1*	1	1	1	1*	1	10
Intention to Updated	1	1*	1*	1	1	1	1	1	1	1	10
Credit Transfer	0	0	1	0	0	1	1	1	1	1	6
Certificate	0	0	1*	0	0	0	1	1*	1	1*	5
Job Prospect	0	0	1	0	0	0	1	1	1*	1*	5
Assistance from University / College	0	0	1*	0	0	0	1*	1	1	1*	5
Mentor Mentee support	0	0	1*	0	0	0	1	1	1	1	5
Dependence Power	4	4	10	4	4	5	10	10	10	10	

Figure-4: Level Partitioning and Conical Matrix

Level Partitioning(LP)				
Elements(Mi)	Reachability Set R(Mi)	Antecedent Set A(Ni)	Intersection Set R(Mi)∩A(Ni)	Level
1	1, 2, 4, 5,	1, 2, 4, 5,	1, 2, 4, 5,	3
2	1, 2, 4, 5,	1, 2, 4, 5,	1, 2, 4, 5,	3
3	3, 7, 8, 9, 10,	1, 2, 3, 4, 5, 6, 7, 8, 9, 10,	3, 7, 8, 9, 10,	1
4	1, 2, 4, 5,	1, 2, 4, 5,	1, 2, 4, 5,	3
5	1, 2, 4, 5,	1, 2, 4, 5,	1, 2, 4, 5,	3
6	6,	1, 2, 4, 5, 6,	6,	2
7	3, 7, 8, 9, 10,	1, 2, 3, 4, 5, 6, 7, 8, 9, 10,	3, 7, 8, 9, 10,	1
8	3, 7, 8, 9, 10,	1, 2, 3, 4, 5, 6, 7, 8, 9, 10,	3, 7, 8, 9, 10,	1
9	3, 7, 8, 9, 10,	1, 2, 3, 4, 5, 6, 7, 8, 9, 10,	3, 7, 8, 9, 10,	1
10	3, 7, 8, 9, 10,	1, 2, 3, 4, 5, 6, 7, 8, 9, 10,	3, 7, 8, 9, 10,	1

Level Partitioning Iterations

Elements(Mi)	Reachability Set R(Mi)	Antecedent Set A(Ni)	Intersection Set R(Mi)∩A(Ni)	Level
1	1, 2, 3, 4, 5, 6, 7, 8, 9, 10,	1, 2, 4, 5,	1, 2, 4, 5,	
2	1, 2, 3, 4, 5, 6, 7, 8, 9, 10,	1, 2, 4, 5,	1, 2, 4, 5,	
3	3, 7, 8, 9, 10,	1, 2, 3, 4, 5, 6, 7, 8, 9, 10,	3, 7, 8, 9, 10,	1
4	1, 2, 3, 4, 5, 6, 7, 8, 9, 10,	1, 2, 4, 5,	1, 2, 4, 5,	
5	1, 2, 3, 4, 5, 6, 7, 8, 9, 10,	1, 2, 4, 5,	1, 2, 4, 5,	
6	3, 6, 7, 8, 9, 10,	1, 2, 4, 5, 6,	6,	
7	3, 7, 8, 9, 10,	1, 2, 3, 4, 5, 6, 7, 8, 9, 10,	3, 7, 8, 9, 10,	1
8	3, 7, 8, 9, 10,	1, 2, 3, 4, 5, 6, 7, 8, 9, 10,	3, 7, 8, 9, 10,	1
9	3, 7, 8, 9, 10,	1, 2, 3, 4, 5, 6, 7, 8, 9, 10,	3, 7, 8, 9, 10,	1
10	3, 7, 8, 9, 10,	1, 2, 3, 4, 5, 6, 7, 8, 9, 10,	3, 7, 8, 9, 10,	1
1 2 3				

Conical Matrix(CM)

Variables	3	7	8	9	10	6	1	2	4	5	Driving Power	Level
3	1	1	1*	1	1	0	0	0	0	0	5	1
7	1*	1	1*	1	1*	0	0	0	0	0	5	1
8	1	1	1	1*	1*	0	0	0	0	0	5	1
9	1*	1*	1	1	1*	0	0	0	0	0	5	1
10	1*	1	1	1	1	0	0	0	0	0	5	1
6	1	1	1	1	1	1	0	0	0	0	6	2
1	1	1	1	1	1	1	1	1	1	1	10	3
2	1	1	1	1*	1*	1	1*	1	1	1	10	3
4	1	1	1	1*	1	1	1	1*	1	1*	10	3
5	1*	1	1	1	1	1	1	1*	1	1	10	3
Dependence Power	10	10	10	10	10	5	4	4	4	4		
Level	1	1	1	1	1	2	3	3	3	3		

Reduced Conical Matrix(CM)

Variables	3	7	8	9	10	6	1	2	4	5	Driving Power	Level
Eagerness to expand Knowledge	1	1	1*	1	1	0	0	0	0	0	5	1
Certificate	1*	1	1*	1	1*	0	0	0	0	0	5	1
Job Prospect	1	1	1	1*	1*	0	0	0	0	0	5	1
Assistance from University / College	1*	1*	1	1	1*	0	0	0	0	0	5	1
Mentor Mentee support	1*	1	1	1	1	0	0	0	0	0	5	1
Credit Transfer	1	1	1	1	1	1	0	0	0	0	6	2
Curiosity to Learn	0	0	0	0	0	1	1	1	1	1	10	3
Reputation of platform	0	0	0	0	0	1	1*	1	1	1	10	3
Flexibility and Access to contents	0	0	0	0	0	1	1	1*	1	1*	10	3

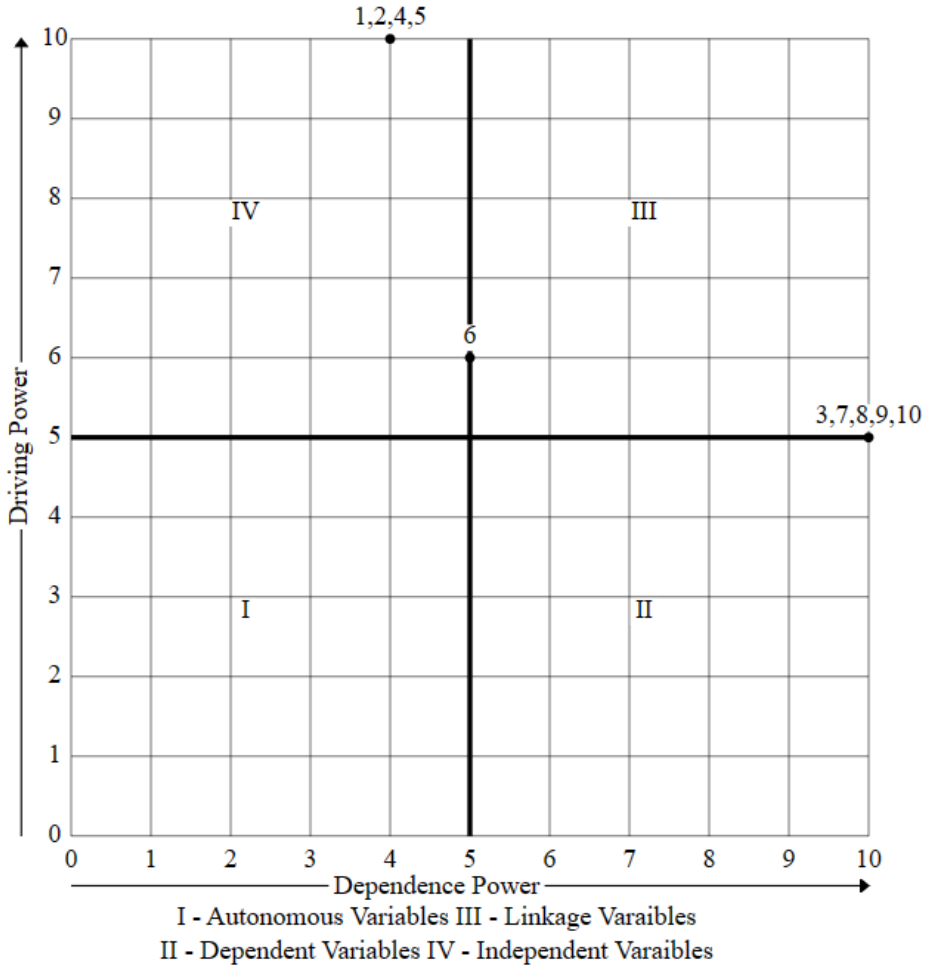
Level Partitioning

The LP and conical matrix indicate that the variables are partitioned differently, aiding in Micmac analysis and the creation of the final model. This process establishes connections between the variables, leading to the identification of linking variables that connect the dependent variable to its independent counterparts.

MICMAC Analysis

In the field of study, there are four types of variables with varying levels of influence and dependence. Autonomous variables have minimal driving power and are not connected to the structure. Dependent variables have low causative influence but rely heavily on other variables. Linkage variables have a strong impact and react to the variables in the system. Independent variables have significant driving forces and minimal interdependence. The fourth quadrant of the study focuses on independent variables, including learning curiosity, reputation, flexibility, and intention to update. These variables are crucial factors in the study. Additionally, the study considers credit transfer as a linkage variable, as shown in Figure 5.

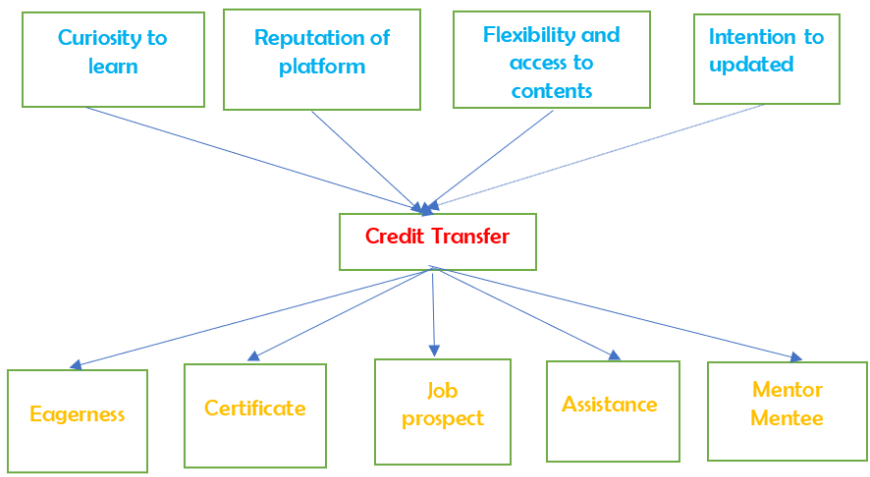
Figure-5: MICMAC Analysis



Final Model

The final model shows that learning curiosity, reputation, flexibility, and intention to update are significant variables in the top-level model, as illustrated in Figure 6. These variables can catalyze other parties to achieve their goals. They are independent factors that can influence other variables under investigation. India, as a developing economy, has witnessed remarkable technological advances and automation in education in recent years. The rapid growth of technology has positively impacted education by making learning available 24/7 to people. The variables at the bottom of the model, including eagerness, certification, job prospects, assistance, and mentor-mentee support, are dependent variables with no driving power.

Figure-6: Final Model



Conclusion & Suggestions

Conclusion

When it comes to MOOC learning design, the focus tends to be on individualized learning rather than collaborative learning. This is because managing the diverse range of people who form networked learning communities can be difficult. As a result, there is limited experience in using ICT to create new pedagogical models. However, despite using a traditional approach, there are still elements in their pedagogical discourses that contradict this perspective by emphasizing teaching centred on the student's learning process. This shows their effort to adapt to the current reality and is consistent with their innovative background. Variables such as curiosity, reputation, flexibility, and intention play a crucial role in driving other variables in the final model. The certificate is a crucial link between the independent and dependent variables. The study's dependent variables include credit transfer, assistance, mentor-mentee support, job prospects, and eagerness.

Implications

It is essential for educational institutions to take into account several key factors when developing MOOC (Massive Open Online Course) offerings. By doing so, they can significantly enhance learner engagement and foster genuine curiosity in individuals who seek to improve their skills. One of the most influential elements is the concept of credit transfer. This particular aspect

plays a crucial role in shaping the interest of a diverse range of learners in MOOCs, especially in light of the new education policy. Under this policy, learners have the opportunity to earn credits that can be captured and reflected in their Academic Bank of Credits. This system not only incentivizes participation but also underscores the value of continuous learning and skill development in today's educational landscape.

Limitations

In conducting the study, we had to narrow our focus to only ten variables and disregard all other variables. It is one of the limitations of our research. We utilized interpretive structural modelling as a research technique to analyze the relationships between the variables. However, other research techniques also focus on model building and the significance of the models. We chose interpretive structural modelling because it is specifically designed to examine the relationships between the variables.

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Faking it: Artificial Intelligence in a Human World

(By Toby Walsh, Speaking Tiger Books, New Delhi, 2023, pp. 248)

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In Faking It: Artificial Intelligence In a Human World, Toby Walsh, a leading Professor of Artificial Intelligence (AI), provides a thought-provoking and accessible exploration of the rapid advancements in AI and their profound implications on humanity. The book begins by dispelling common misconceptions about AI, clarifying that current systems are not sentient enough and do not have a genuine understanding or consciousness like humans do. However, Walsh masterfully illustrates how AI is already surpassing human capabilities in many domains, from playing complex games to diagnosing diseases. He begins his book in the preface with the first line stating that this book is out of date, as the speed, skill and scale of AI is so rapid and dynamic that by the time one finishes reading the book, a new development would have taken place in the world of AI and computing.

The book's title is an ominous reference to the danger posed by AI that becomes capable enough to imitate human intelligence to the level of perfection. This becomes problematic, especially when corporations start to build systems and mechanisms designed to deceive human intelligence by surrounding us with deepfakes, computer-generated audio and videos that are identical to the real thing. In the field of Education and Learning, AI poses a new and advanced challenge. With the breakout of ChatGPT, Sora (text-video generation) and its subsequent alternatives, AI has become even more ubiquitous than before. Adept at writing school or college assignments, research articles, editorials or even food recipes, the limit to the Generative Pre-trained Transformer (GPT) is only the prompts that are given. Beyond that, there is no control over the veracity of the content, originality of the write-up or even the authenticity of its sources. In a world where fake news and unverified claims spread faster than a forest wildfire, having a language learning model taking over human actions has far-reaching and substantial consequences.

One of the book's key strengths is the way Walsh contextualizes the development of AI within the broader sweep of human history and technological innovation. He draws insightful parallels between the current AI revolution and past technological disruptions, helping readers appreciate both the transformative potential and the existential risks posed by intelligent machines. A particular highlight is the author's nuanced discussion of the ethical challenges surrounding AI. He delves into the issues of algorithmic bias, privacy, algorithmic decision-making, and the displacement of human labour. Walsh does not shy away from hard questions, making a compelling case for the urgent need to ensure AI systems are designed and deployed with robust safeguards and a strong moral framework.

With the advent of thinking computers dating back to research conducted by Alan Turing, a British mathematician, titled Computing Machinery and

Intelligence to the coining of the term AI six years later by John McCarthy, an American computer scientist, we have come a long way for machines to guide our thoughts. This has led to algorithms being designed in a way that understands our tastes and preferences in films, music, and social media, churning out suggestions that keep us hooked online. However, Walsh attempts to inform us through his work that AI can actually never become as intelligent or creative as humanly possible.

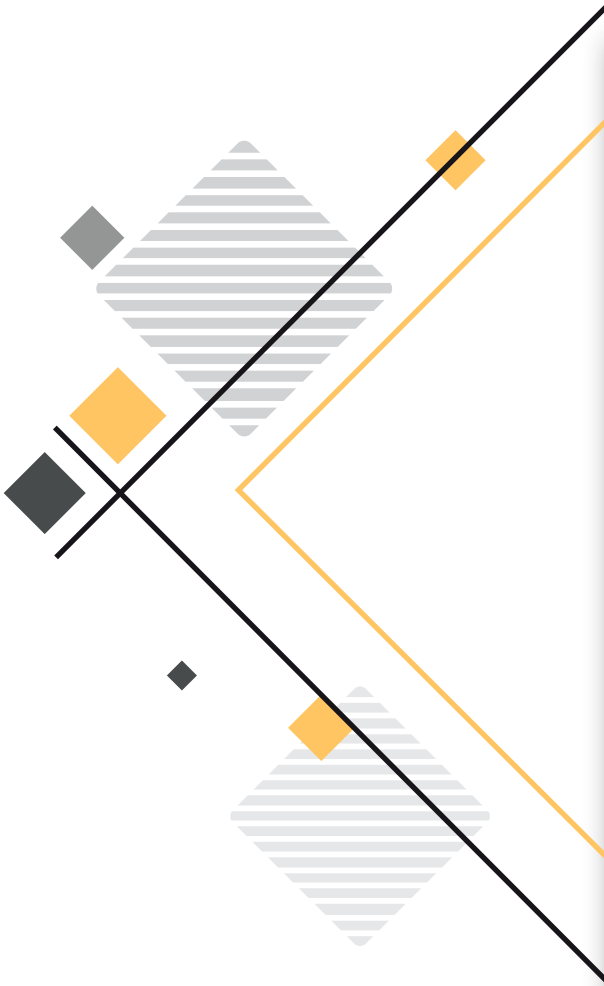
It thus becomes pertinent to ask, for the purposes of the discussion in this book, can AI be creative? The answer lies in the title of the book. Walsh argues that AI can only assist as much as it is being assisted. Its learning is limited to the scope of its data. AI can be creative, but only for 'Faking Creativity'. Walsh makes a compelling case in "Faking It" that while AI systems have become remarkably adept at producing human-like creative outputs, true creativity remains elusive.

The key lies in understanding the fundamental differences between artificial and human creativity. For example, AI language models like GPT-3 can generate remarkably coherent and even poetic text when prompted with the right inputs. They can compose short stories, poems, and even song lyrics that may initially seem creative. However, this "creativity" is ultimately a reflection of the training data the AI was exposed to, not an innate spark of original thought. Similarly, AI art generators like DALL-E can produce unique and visually striking images based on textual prompts. But these images are essentially collages of visual elements the AI has encountered before, recombined in novel ways rather than manifesting truly original ideas.

The title "Faking It" is apt because while these AI-generated outputs may appear creative on the surface, they lack the deeper human qualities of creativity. A human artist or writer draws from their lived experiences, emotions, and unique perspectives to craft something that is genuinely novel. In contrast, AI creativity is ultimately bounded by its training, unable to transcend the limitations of its data. The machine learning models powering creative AI are powerful tools, but they do not possess the same spark of imagination, intuition, and personal expression that distinguishes human creativity. The AI is, in a sense, "faking" creativity by replicating patterns it has learned rather than generating truly original ideas. This distinction is crucial for understanding the capabilities and limitations of AI, especially as these technologies become more advanced and integrated into our lives.

One potential criticism of Toby Walsh's "Faking It" is that the book, at times, oversimplifies the complexities and nuances of artificial intelligence. While the author does an admirable job of making technical concepts accessible to a general audience, there is a risk of painting AI capabilities and limitations with too broad a brush. For example, Walsh's assertion that current AI systems are not sentient and do not have genuine understanding or consciousness as humans do is a widely accepted view, but the question of machine consciousness remains an active area of philosophical and scientific debate. The nature of consciousness and whether it can truly emerge in artificial systems is still not fully understood. Similarly, Walsh's characterization of AI creativity as mere "faking" may overlook the potential for AI systems to generate outputs that, while not truly original in a human sense, still demonstrate novel combinations and emergent properties that push the boundaries of what we consider creative. As AI techniques become more sophisticated, the line between artificial and human creativity may continue to blur.

That said, these criticisms do not detract the reader from the overall quality and importance of Walsh's work. Faking It remains a highly informative and accessible introduction to the current state of AI, its capabilities, and the critical challenges it presents. In conclusion, Faking It is a masterful exploration of the past, present, and future of artificial intelligence. Toby Walsh's insights and warnings serve as a vital roadmap for navigating the transformative, and at times unsettling, implications of AI. This book is an essential read for anyone seeking to understand the technology that is rapidly reshaping our world. While AI can enhance and augment human creativity, it cannot replace the depth and uniqueness of the human creative experience - at least not yet.



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